15 JANUARY 1954

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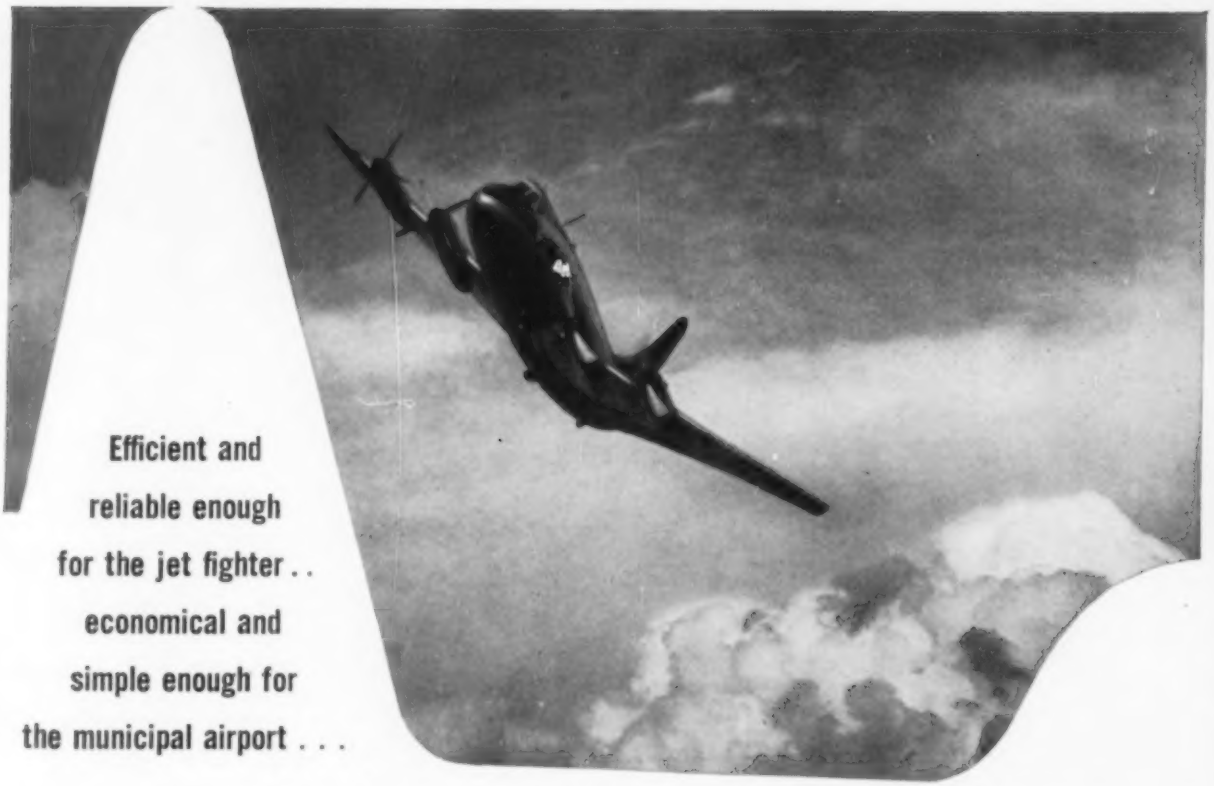

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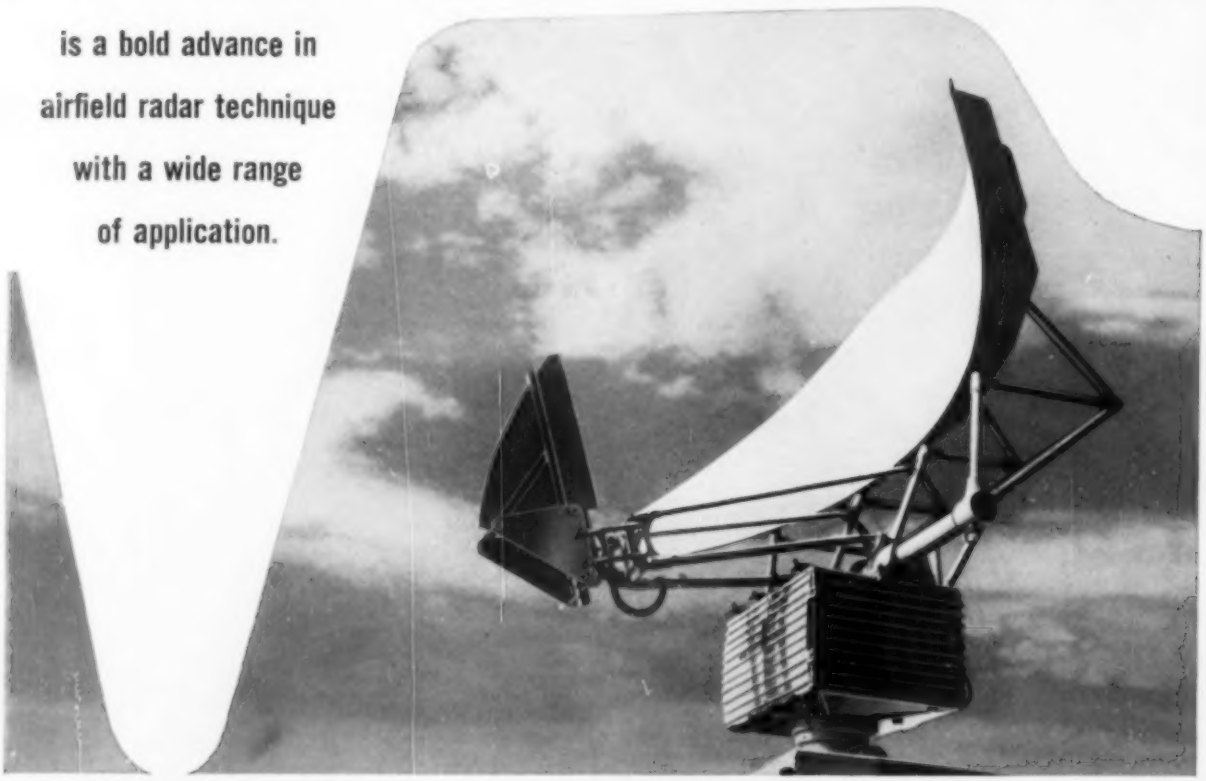

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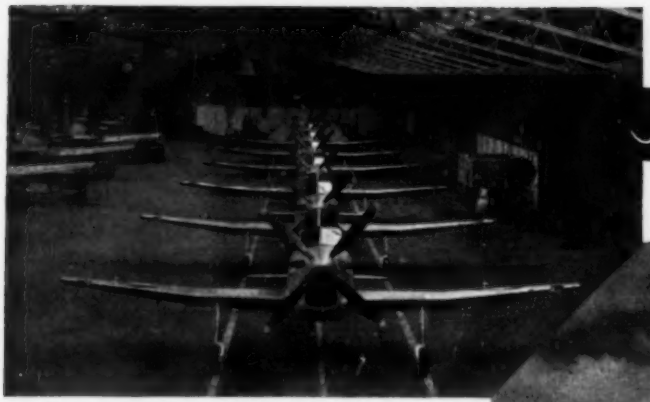

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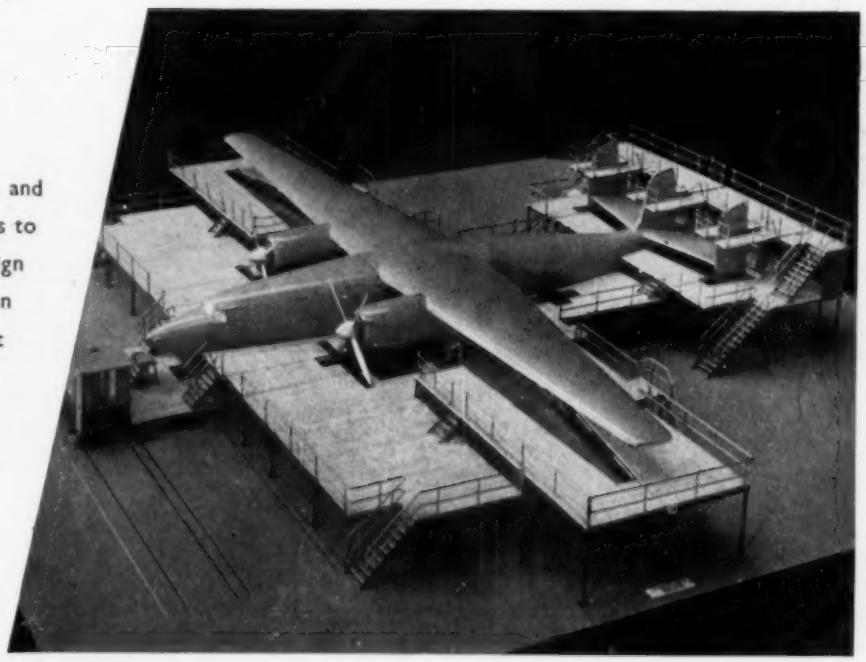

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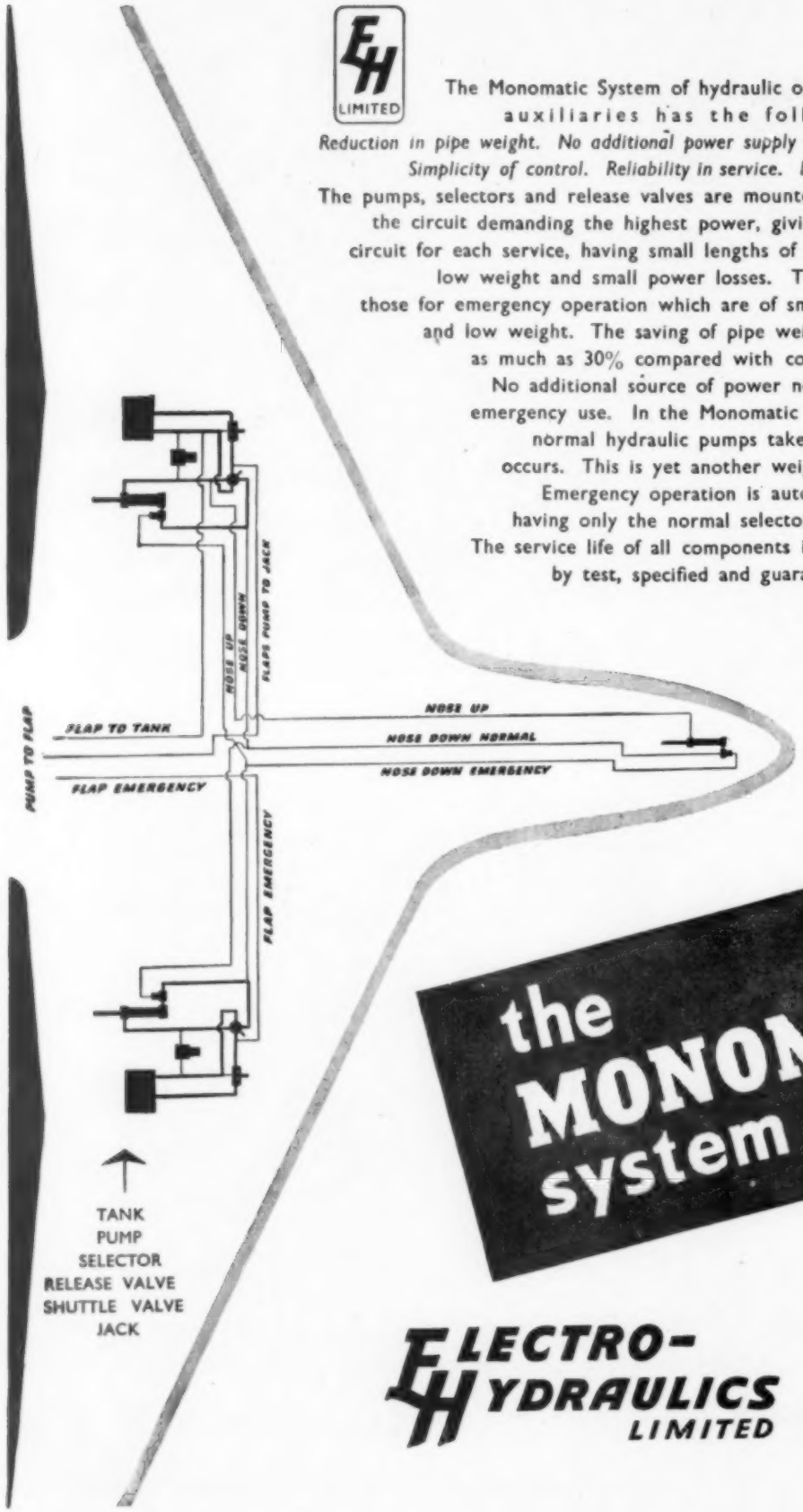

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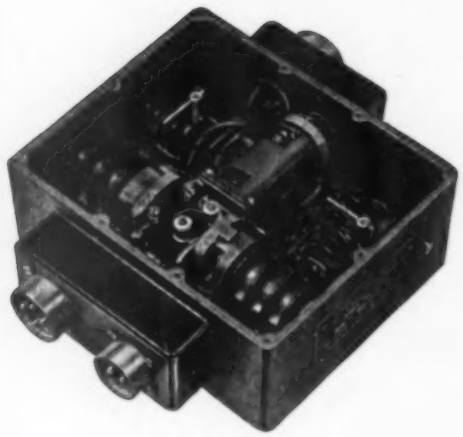

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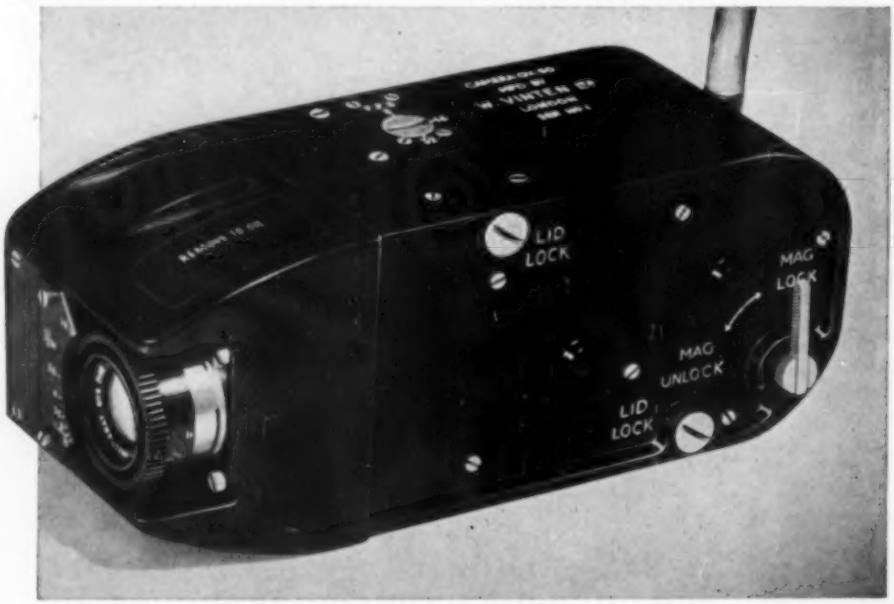

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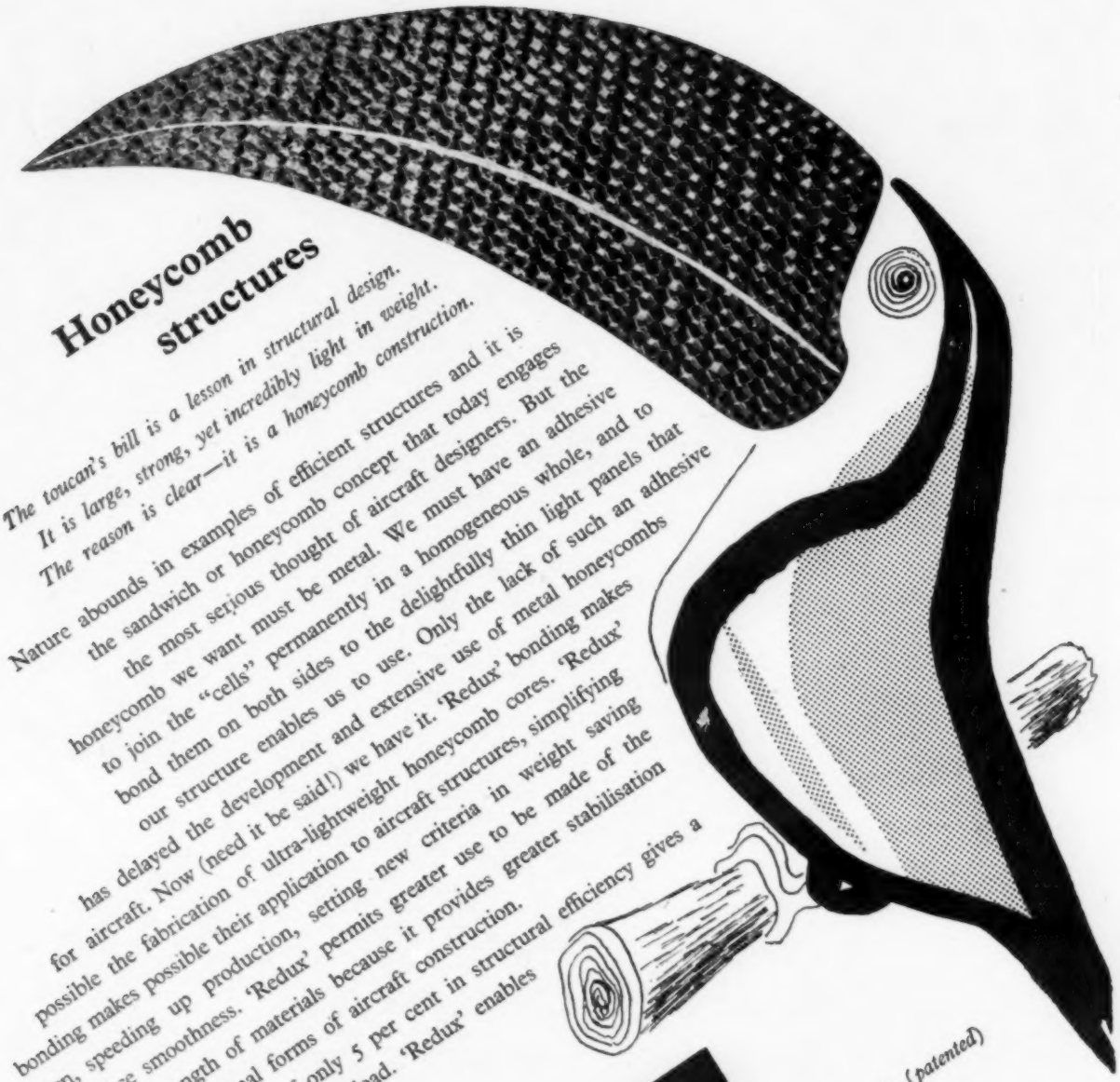

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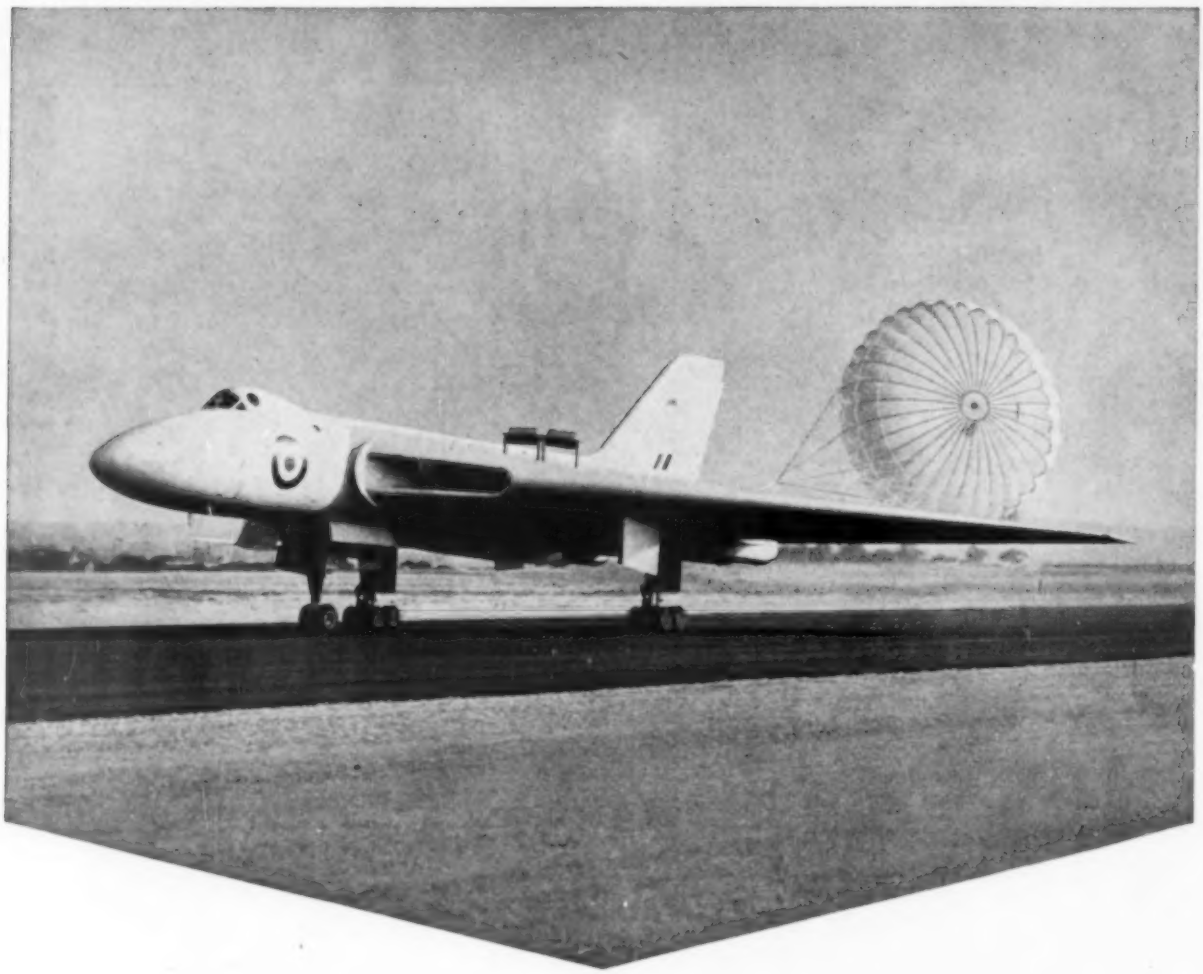

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First Aeronautical Weekly in the World

Founded 1909

No. 2347 Vol. 65. FRIDAY, 15 JANUARY 1954

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LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

Branch Offices:

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IN THIS ISSUE:

Martin Canberra Developments - - - 60
Sabres and Furies - - - 63
Fokker S.14 in the Air - 68
Helicopter Development - 73
Manufacture and Maintenance - - - - - 74
B.E.A.'s Engineering Base 80

Achievement and Prospect

FOR more than one reason it was gratifying to observe the wide publicity and response accorded to a remark made by Sir Thomas Sopwith, chairman of the Hawker Siddeley Group, in his annual statement. First, the reaction to his contention that Britain's "long lead in jet power has not only been cut down but in certain respects lost," clearly reflects a growing appreciation by the educated public of the importance of our aircraft industry. Secondly, it is always pleasant to have one's own stated convictions confirmed by someone at the fountain-head. There can be no further excuse—if any had previously existed—for complacency or inaction. Following his remark quoted above, Sir Thomas went on to say:—

> "I think we are jeopardizing our position through timidity—and we are nurturing that timidity with complacency. We as a nation should now be spending much greater sums of money on high-altitude and high-speed research . . . We should probe far beyond it and go higher and higher into the stratosphere with our research work so that these things which are mysteries now will be commonplace tomorrow . . .
>
> "The drive and imagination of our scientists has contributed vitally to the development of atomic power, but where are our research projects for applying nuclear fission to aircraft propulsion? We should be working on this now?"

We may, perhaps, be excused for repeating a few sentences from our recent leading articles, not in any "we-told-you-so" spirit, but to stress our convictions and join forces with Sir Thomas. On April 17th last year, under the heading "Time for the Next Step," we referred in some detail to American plans for atomic power units. We spoke of the importance of good timing and courageous planning, and in addition quoted Air Commodore Banks—"Remember that failure to take the next step to order a new engine may mean ten years in the wilderness." We concluded our remarks by stating that preoccupation with the many other problems and developments must not lead us to overlook or delay preparation for the next step which had already been taken in America. Less than two months ago we wrote of research:—

> "There is no doubt that in the coming years aircraft, both military and civil, will travel faster and faster above the speed of sound and above our atmosphere. The practical knowledge required to design the aircraft and their control systems and to build, equip and operate them successfully is being accumulated by America and scarcely at all by ourselves."

The warning included in the chairman's statement was regarded as so important that it was inevitably singled out in many newspaper reports to the exclusion of almost everything else, and what can justly be described as a meaty, readable and very encouraging review of the Group's activities received less attention than it deserved. Among passages of particular interest were those in which he pointed out the relationship between size of orders, rate of production, extent and cost of tooling, and the risk of inflexibility when extensive jigging and tooling is employed. He added a constructive suggestion, overlooked in all the reports we have seen: "I would say to any keen young man with good technical qualifications who wants to become an aircraft designer: why not instead consider a career as a production engineer?"

On another production matter he said: "High Duty Alloys have made an outstanding contribution to the production of axial compressor engines by the development and production of close-to-form compressor blades. They are today the leading manufacturer in Europe of compressor blades." Little more than a year ago the blade-production bottleneck, as it was often termed, was regarded as an international problem. Much work still remains to be done, but the progress made in a short time has been most creditable. Other noteworthy and encouraging disclosures concerned Sapphire production at Brockworth, which is ahead of schedule, and progress with guided missiles.

Towards the end of his remarks Sir Thomas gave it as his opinion that it is in the display of flexibility, the ability to face up to new problems as they arise from day to day and find the right answers to them, that private enterprise is unequalled: "It provides leadership and vision instead of the dead hand of bureaucracy . . ." His concluding offer and challenge to the Government to co-operate in exploring new fields should be taken up without delay. Supersonic research aircraft are one necessity. "Let us be bold. Let there be no hesitation," he says. And drawing once more on our earlier writing we ourselves would reiterate: "Any thought of resting on our laurels must be forgotten. Bold action and heavy expenditure on research will alone keep this country among the leaders."

FROM ALL QUARTERS

B.O.A.C. Comet Lost: Services Suspended

WITH deep regret *Flight* has to record that Comet G-ALYP—the aircraft which on May 2nd, 1952, inaugurated the world's first scheduled airline service to be operated by jet airliners—was lost, together with all the 29 passengers and six crew aboard, when it descended into the Mediterranean on Sunday, January 10th. The following day B.O.A.C. announced the temporary suspension of Comet services, to permit close examination of the entire fleet.

Commanded by Capt. A. Gibson, D.F.C., the Comet was one of B.O.A.C.'s fleet of eight Series 1s. At the time of the accident, which is thought to have occurred just before 1000 hr G.M.T., it was flying from Rome to London on the last leg of a service from Singapore (one of 11 extra flights scheduled for mid-winter on this route).

The time of "chocks away" at Rome was recorded as 0931. The first stages of the climb to cruising height were apparently uneventful, as routine messages only were passed to Rome control, the last being at 0950. Nothing more was heard until fishermen reported seeing an aircraft fall into the Mediterranean between the islands of Elba and Monte Cristo; at least one had previously recognized the sound of the machine as being that of a jet aircraft. Some witnesses spoke of explosions in the air and others reported that smoke was coming from the aircraft.

Such reliable evidence as is available at the time of writing leaves little doubt that the impact of the Comet on the water was extremely violent and that its descent was uncontrolled. Fifteen bodies were recovered shortly afterwards, together with small pieces of wreckage. (Large-scale sea and air searches and rescue services had been initiated by Italian, American and R.A.F. organizations immediately after the alarm had been given.) The disaster is thought to have taken place about eight minutes after the final message at 0950, by which time the Comet would presumably have been between 20,000 and 30,000ft.

Captain Gibson, who was 31, had over 5,500 flying hours to his credit, of which he had flown 4,267 since joining B.O.A.C. in 1946. The other members of the crew were: 1st/Off. W. J. Bury, Eng/Off. F. C. Macdonald, Rad/Off. L. McMahon, Steward F. L. Saunders and Stewardess Jean Clark.

Among the passengers were six children. The adults included Mr. Chester Wilmot, the famous Australian broadcaster and writer; Captain V. Wolfson, O.B.E., V.R.D., M.A., R.N.V.R., director of B.E.A.'s associated companies and the general manager of B.O.A.C.'s subsidiaries; Captain C. Livingstone, a B.E.A. Pionair pilot; Mr. J. P. Hill, B.O.A.C. assistant sales manager in South East Asia, and six other members of B.O.A.C. staff or their relatives.

Two members of the M.T.C.A. accident investigation branch left London for Rome a few hours after the loss of G-ALYP, accompanied by Mr. B. J. Folliard of the B.O.A.C. accidents branch and a D.H. field service engineer, Mr. P. J. Detmold.

Up to the time of the disaster Comets had flown over 30,000 hr, of which some 3,500 had been logged by G-ALYP. The overall total included 12m miles of flying in scheduled airline service, with four Comet operators then flying some 180,000 miles weekly. Production of Series 1 and 1A Comets totals 21, including two prototypes, the first of which has been dismantled for structural tests at the R.A.E., Farnborough.

Two previous accidents involving the loss of Comets had resulted from an excessively nose-up attitude during take-off and thus obviously had no relation to last Sunday's accident.

On May 2nd last year 43 people were lost when B.O.A.C. Comet G-ALYV disintegrated in the air shortly after taking off from Calcutta for Delhi while flying through a heavy storm. The Indian official report on this accident was inconclusive and detailed study of wreckage with a view to finding the cause has not yet been completed. So far as the results of salvage operations permit, it is certain that a similar analysis will be made of the wreckage of G-ALYP. There appears to be a good chance of retrieving a major portion of the aircraft, which has been approximately located in water 260ft. deep.

In the circumstances, it was not at all surprising when, on Monday evening, B.O.A.C. announced that "as a measure of prudence" all their normal Comet passenger services would be temporarily suspended from midnight. This suspension, the statement said, would permit a "minute and unhurried technical examination of every aircraft in the Comet Fleet to be carried out at their maintenance headquarters at London Airport . . . to be conducted in closest collaboration with the de Havilland Aircraft and Engine Companies and with the Air Registration Board." The Minister of Transport and Civil Aviation had been consulted and concurred with this B.O.A.C. decision.

It was emphasized that the decision to suspend services was a commercial one, and was not "an official grounding."

There are three other Comet operators—Air France, U.A.T. and the R.C.A.F., all of whom use Series 1As. Both French airlines have announced temporary suspension of their Comet services, but at the time of going to press the R.C.A.F. had announced that they saw no reason at present to ground their machines.

Nash Collection for R.Ae.S.

SIR WILLIAM FARREN, President of the Royal Aeronautical Society, discloses that some months ago Mr. R. J. G. Nash decided that he would be obliged to dispose of his collection of historic aircraft, which he had long hoped might form the nucleus of a National Air Collection. Though favourably disposed to the suggestion that there should be such a collection, the council of the Society (particularly in view of the storage problem) had not then been in a position to put forward a considered proposal with the object of securing public support.

In November an offer came from America. Mr. Nash was anxious that the collection should not leave the country and at a meeting on November 26th the council unanimously decided that an attempt should be made to buy the collection. Mr. Peter Masefield and Mr. Peter Brooks negotiated with Mr. Nash and a price within the sum authorized by the council was agreed on December 10th. Sir William Farren then authorized completion of the purchase. A further announcement will be made when the council has considered how best to deal with the future of the aircraft. They are: Blériot XIA (1910), Blériot XXVII (1911), Cauldron G.3 (1912), Maurice Farman F.40 (1913), Avro 504 (1914), Sopwith Camel (1917), Fokker D.VII (1918), S.E.5A (1918).

South African Shackletons

IN face of strong American competition A. V. Roe and Co. Ltd. have secured an order for an unstated number of Shackleton maritime-reconnaissance aircraft. News of the order was simultaneously released in South Africa by Mr. F. C. Erasmus, Minister of Defence, and in England by Sir Roy Dobson, who recalled the cruise, in April last year, of Shackletons of No. 42 Squadron from Ceylon to the Union during a 17,000-mile round trip from their home base. Mr. Erasmus added that deliveries are expected to commence within 15

WESTWARD WITH THE SUN: a Shackleton 2 of No. 42 Squadron, setting out for a long patrol over the Atlantic, forms the subject of this impressive "Flight" photograph. As recorded above, aircraft of this basic type are the subject of a South African order.

months. The mark of Shackleton concerned is not revealed, but rumours have connected the designation Shackleton M.R.3 with a nosewheel development of the present M.R.2.

Merchant Air Navy?

LAST week a brief statement reached us, in the following terms: "The Minister of Transport and Civil Aviation, Mr. A. Lennox-Boyd, on Thursday, January 7th, received a deputation, headed by Air Chief Marshal Sir Guy Garrod, chairman of the Air League of the British Empire, and which included representatives of the Guild of Air Pilots and Air Navigators of the British Empire and of the British Air Line Pilots' Association, and discussed questions concerning the recognition and status of the Merchant Air Service, and particularly the inclusion of its representatives on public ceremonial occasions."

The thought behind this announcement goes back for a long time, but the approach to the Air Ministry was made only a few months ago by the Air League, with the support of G.A.P.A.N. and B.A.L.P.A. In much the same way as the Merchant Navy is related in peace and war to the Royal Navy, the Merchant Air Service—a uniformed and disciplined organization—is related to the Royal Air Force. Most of our readers will recall the gallant part played by the aircrews from the Merchant Air Service in the evacuation of France, Greece and Crete, of the supplying of British Armies in the desert, and the provisioning of Malta.

This contribution by Merchant airmen was recognized at the end of the war in the Air Council's victory message to B.O.A.C. The message recorded that "Their achievements have become a part of history and a foundation of a glorious tradition for the British Mercantile Marine of the Air."

Today, Transport Command of the R.A.F. is a relatively small organization, and it is clear that in the event of another war the three Services would lean very heavily upon the crews of the Merchant Air Service for air trooping, supplies and communications.

Until official recognition is accorded to the Service and its title, thus bringing it in line with the Merchant Navy and Fishing Fleet, there is no way in which it can be officially represented on important public occasions. It will be recalled that at the time of Her Majesty's departure on her world tour she adopted the title, first assumed by her father, King George VI, of "Master of the Merchant Navy and Fishing Fleet."

Senior M.o.S. Officials at Rotax

ON Tuesday, January 5th, Mr. A. R. W. Low, Parliamentary Secretary to the Ministry of Supply, visited the main Rotax factory at Willesden and the company's new plant at Hemel Hempstead, Herts. It is his policy to undertake such visits throughout the industry and he believes he has been to every contracting factory at least once during his two years in office.

On this occasion he was accompanied by Mr. L. J. Dunnett, Deputy Secretary; Mr. L. R. Beesley, Director of Engine Production; Mr. B. D. Davies, Director of Aircraft Equipment Production; and his private secretary, Mr. G. M. P. Myers. The party were escorted on their tour by Mr. A. B. Waring, chairman of Joseph Lucas (Industries), Ltd.

The inspection began at the Hemel Hempstead factory, which is a completely new building now nearing completion. As each portion of the plant was erected it was put into production, the tools being installed in their final places so that, as the operating floor area grows, no rearrangement will be required. Production began here in the late summer of 1952 and all 270,000 sq ft will shortly be in use on super-priority work.

The afternoon was spent at Willesden, both in the production shops and at the Rotax laboratories. The diversity of the company's products, including turbo-starters, electric equipment of every kind for all types of aircraft, and a growing range of electronic gear, provided many topics for discussion (picture, page 62).

LOOKING AHEAD: Sir Thomas Sopwith, C.B.E., chairman of the Hawker Siddeley Group, whose recent observations on British research and other topics of high importance have occasioned lively comment and are the subject of the leading article in this issue.

Rolls-Royce Agreements

THE recent agreement between Rolls-Royce, Westinghouse and a Swedish company for interchange of information has aroused some interest in Italy. The Italian journal *Alata* hints that the scheme is so attractive that other European companies may seek to take advantage of it; Hispano Suiza (France) and the Sulzer and Brown Boveri concerns (Switzerland) are mentioned.

The basic agreement, valid for ten years, apparently allows a company to join the scheme by payment of a fixed sum; thereafter it may produce under licence, or design new engines as desired, making full use of Rolls-Royce knowledge and experience. The British company then receives a royalty on all engines produced by the foreign firm, whatever their origin. The agreement may also apply to marine and industrial turbines and to engines (e.g., by-pass types) of completely new conception.

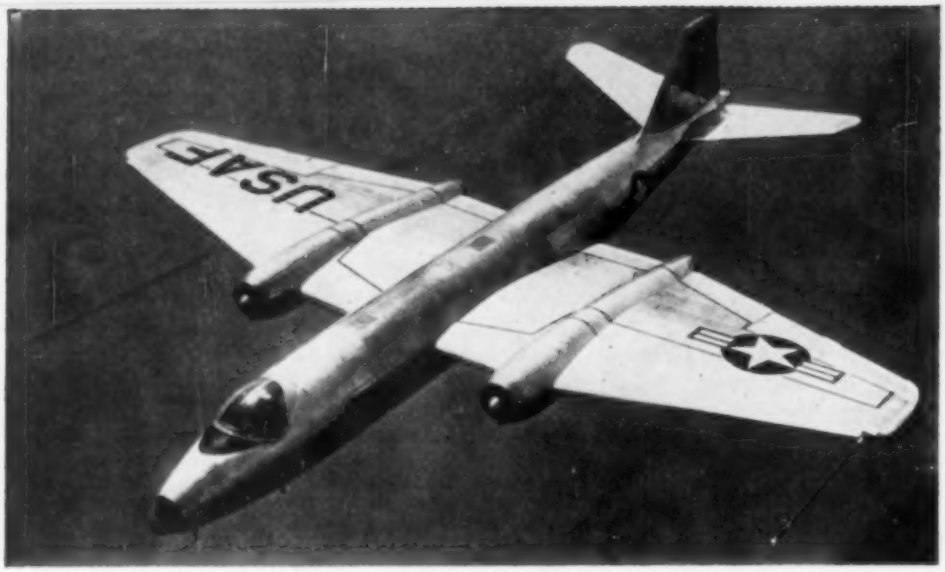
Catching Them Young

ON January 7th the Royal Aeronautical Society held a lecture for young people, and thus revived an old custom which fell into disuse some 20 years ago. It took place in the lecture hall of the Institution of Mechanical Engineers, and was given by Professor Sir Leonard Bairstow, C.B.E., F.R.S., F.R.Ae.S., the distinguished aeronautical scientist and a former chairman of the R.Ae.S., who gave a lecture in the same series 30 years ago.

The talk—given to about 100 enthusiasts between about 10 and 16 years af age—was entitled *It's Fun Finding Out in Flying*, and ranged over a variety of subjects illustrated by a series of lantern slides. These presented some of the more outstanding types of British aircraft, and the instruments of research, such as wind tunnels, which had played a large part in bringing them into existence. Also in the programme was a film, lent by Handley Page, Ltd., showing the behaviour of airflows in contact with bodies of various shapes, and the changes brought about by the use of slots and suction devices.

In the unavoidable absence of Sir William Farren, president of the Royal Aeronautical Society, the chair was taken by Mr. Peter Masefield (vice-president of the Society), who expressed the hope that these lectures would once again become a regular feature of the Society's programme.

SONIC TRAINER: As mentioned on page 65, an early North-American F-86F Sabre has been fitted up as a tandem trainer, with full dual control. At present strictly a one-off job, this is probably the only dual-control machine in the world able to exceed Mach 1. Styled TF-86F, it carries two 0.50in guns.



The first Martin B-57A night intruder, powered with Wright J65 turbo-jets (Armstrong Siddeley Sapphire licence).

MARTIN CANBERRA DEVELOPMENTS

American Licencees Claim Mach ·09 Increase at Height

SIGNIFICANT aerodynamic and structural developments in respect of the Martin B-57A—U.S.A.F. night-intruder version of the English Electric Canberra—are described by Mr. Irving Stone in *Aviation Week*, though, as he remarks, the Martin company "has stuck very close to the plane's basic configuration." It is not to be doubted that the parent company contributed substantially, by example and suggestion, to some of the developments he describes, though the extent to which these are being incorporated in British-built Canberras may not be disclosed.

Mr. Stone quotes Mr. O. E. ("Pat") Tibbs, Martin's flight-test manager, as saying that the B-57 has a great development potential, and goes on, "One example of how the plane's potential can be exploited is revealed in a simple airframe sealing job. . . This refinement has given the J65-powered B-57A a Mach .09 speed increase at high altitude before reaching the degree of roughness experienced with Britain's Canberra."

In his discussion of specific improvements, Mr. Stone first deals with controls and cockpit features. Control forces (he quotes Mr. Tibbs) are slightly lower on the B-57 than on the Canberra, and he suggests that this condition "probably stems from a better aileron sealing job obtained in converting from British to American standards, plus the fact that the three control surfaces—elevator, aileron and rudder—have slightly lower spring rates in the tails" [*sic*].

As soon as Mr. Tibbs flew the Canberra he saw the need for air-conditioning. This has been duly incorporated, and Mr. Stone quotes reports that a similar feature is being added to late British Canberras. Toe brakes on the B-57 are said to make ground handling much easier. (On the Canberra a hand brake is used, actuating both wheel brakes, differential action being provided by the rudder.) The new-type cockpit canopy, illustrated in *Flight* of October 2nd, has already been mocked-up and flown on a Martin-operated Canberra. Incorporation of the Martin rotary bomb-bay (described in *Flight* of August 14th, 1953) is said to permit bombing runs at the same speed as fighter/bombers drop their externally carried weapons.

"Of all the changes made in the transition of the Canberra to the B-57," writes Mr. Stone, "the most important probably is the increase in the plane's critical speed limits. The Canberra, like any other plane, is limited not by power and weight but by proved limits of normal control. Limit of normal control may be defined as a combination of speed and altitude conditions beyond which control of the plane is uncertain. The prime limiting factor of Martin's first production B-57A (there was no prototype, as such) was a low-frequency buffet. This condition also occurred with the Canberra. The buffet manifested itself at comparatively low altitudes and at a speed considered too low to tolerate. The buffet affected the entire bomber, but was traced to the tail by means of instrumentation. To remedy the condition, Martin engineers adopted an 'opportunist attitude' instead of the usual time-consuming scientific approach involving windtunnel trials, calculations and other detailed procedures. . . . The method used to obtain the improvement was to seal the tail section, both internally and externally. English Electric did some work on internal sealing in the tail and, on test aircraft, resorted to stiffening the fuselage to overcome the buffeting effect. Martin engineers wanted better results and wanted them quickly."

Mr. Stone explains how, to expedite flight test results, Martin engineers used tape to seal lightening holes and access openings. For example, a paper cone, taped in place, was used to seal the opening where the elevator push-pull rod came through the fuselage tail bulkhead. On the basis of the favourable results obtained with the sealing, metal-and-rubber production seals were designed for these same applications. "Translated into actual speed values," the American writer reports, "the internal sealing resulted in a delaying action of 10 to 15 knots indicated airspeed in the appearance of the low-frequency buffet."

He goes on to describe how another speed dividend was obtained through external sealing. "The trim method on the B-57," he remarks, "is by stabilizer adjustment. This method is used because a reasonable size of trim tab and trim deflection would not be adequate when compressibility effects are encountered. A moveable stabilizer provides adequate trim

Smokeless powder is not used in the B-57A's cartridge starters, with the result shown. Congressmen observing this scene are said to have been visibly shaken.

at any foreseeable speed for this plane. Utilization of this moveable arrangement involves gaps and unsealed openings at and through the fuselage. To reduce the open areas for further improvement of airflow characteristics, Martin engineers sealed the stabilizer at two locations. One of these was on the quarter-round fairing between the horizontal stabilizer and fuselage cone. To facilitate test results, the plane was flown at the high-speed trim condition and landed with the stabilizer in this position. The gap at the quarter-round fairing was filled with a sealing compound and the plane taken up with the stabilizer so sealed. Results indicated that a speed dividend could be obtained in buffet delays."

Still another point of sealing was at the small stub fairing at the leading-edge of the tailplane close to its junction with the fuselage. Two gaps were involved here—one chordwise, one spanwise, and these were sealed with waterproof adhesive tape. Altogether, this external sealing gave another 15-knot increase in speed before the low-frequency buffet occurred, and this, added to that obtained through internal sealing, gave the first production B-57A a 30-knot advantage over its British counterpart.

As a result of this study of the low-altitude (under 10,000ft) buffet problem, an increase in Mach number of .09 at high altitude (over 30,000ft) was obtained "over the accepted R.A.F. limit for the Canberra on compressibility effects." This, Mr. Stone remarks, was a dividend obtained with no extra effort except that of making the improvements considered necessary for the low-altitude condition. "Seals used on the test runs," he reports, "are being replaced with production types. On the quarter-round fairing, a spring-loaded seal extends the entire length of the fairing's surface. On the stub fairing, production seal is being obtained by incorporating a reduced gap on the chordwise length, whereas the spanwise gap is being fitted with a felt filler strip."

Although the B-57A follows Canberra design very closely, a major change was made in the "garden gate"—the main spar carry-through fitting. "On the Canberra," Mr. Stone reports, "this fitting was hogged out of a large forging. Martin engineers did not want to have the part hammer-forged or press-forged in sections, because they did not consider this approach feasible for production. It was found cheaper and quicker to create a corresponding structure from two 3in rolled 75ST plates—fore and aft sections. The structure's configuration is cut out and then machined. It is possible that when the new large presses under the Air Force heavy press programme begin operating, the 'garden gate' fitting again may take the form of a single large forging. Martin already has proposed this make-up."

Seen on the occasion of the delivery of the first B-57A to the U.S.A.F. are (left to right): Lt. Gen. E. W. Rawlings, Commander, Air Materiel Command, U.S.A.F., Dayton, Ohio; Maj. C. J. Clemence, B-57 Joint Project Officer, Wright Air Development Centre (pilot); Lt. Gen. Donald Putt, Commander, Air Research and Development Command, U.S.A.F.; Gen. Nathan F. Twining, Chief of Staff, U.S.A.F.; George M. Bunker, president of the Martin company; O. E. Tibbs, Martin's flight test manager, and Maj. Roy Seccomb, B-57 Joint Project Officer.

AN AUSTER PILOTLESS TARGET

DEVELOPED from the American OQ-3, the Auster B.3 pilotless target, illustrated below, is designed to afford practice with Bren guns attached to 40 mm Bofors. A single-engined, high-wing, strut-braced monoplane, it has a welded-steel-tube fuselage, a wooden wing, and fabric covering. The engine is a 276 c.c. A.B.C. air-cooled flat twin; developing about 6 h.p., it drives a fixed-pitch airscrew of 2ft 6in diameter. Construction is extremely simple and parts damaged by gunfire are quickly replaceable. The wing is of constant chord and section, and has two solid spruce spars, plywood ribs and a plywood-covered leading edge. It is easily attached by means of a long retaining pin inserted through a hole in the leading edge and locating in lugs on the fuselage. There are no ailerons. The fuselage is of vee-section and houses the fuel tank, parachute and radio-control unit. The fin and the port and starboard tailplane panels are interchangeable.

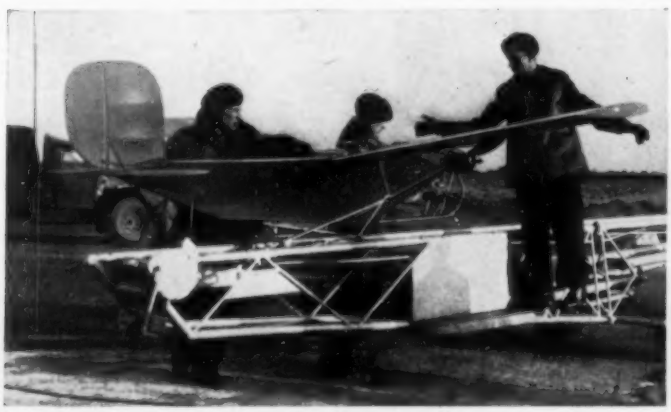
Radio control is effected through a small column operated by the "ground pilot." Signals initiated by moving this column are received by an aerial which protrudes through the port side of the fuselage; they are fed to a servo-motor from which link-rods to the rudder and elevator control the direction of flight. The little machine is capable of loops and "rolls-off" and can be turned and dived steeply. Turns are effected by the rudder, but a small amount of elevator is necessary to keep the nose up. By interconnecting two or more control sticks it is possible to give instruction to embryo "ground pilots," and a switch on the instructor's control box allows him to take over as he wishes.

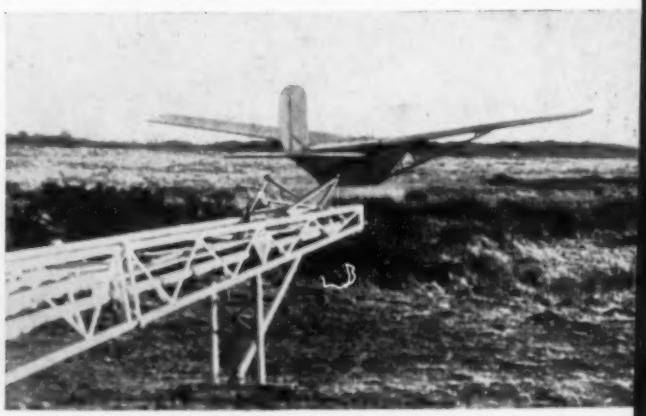
Should the target still be flying on the completion of a shoot, or if its limit of duration is being approached, it may be recovered by means of a parachute, which deploys automatically when the operator presses a button on the control box. The engine is simultaneously cut. There is no undercarriage, but a small protective frame below the engine guards against landing damage and the airscrew is so fitted that it assumes a horizontal position when the engine is stopped.

The target is launched, from a 37ft ramp of tubular construction, by means of a small cradle which is winched back against the pull of powerful tension springs.

Principal data are: span, 12ft 3in; length, 9ft; chord, 1ft 9in; dihedral, 7 deg; top speed (straight and level), 120 m.p.h.; duration 1 hr; maximum operating height, 2,000ft; normal operating height, 500ft.

The Auster B.3 target has its airscrew swung (left) and leaves the catapult (right). Note the curved frame to protect the engine and, on the catapult, the winch handle by which the launching cradle is drawn back against the tension of powerful springs.





HERE AND THERE

TORQUE INTO THRUST: One of a recent series of Turbo-Hydromatic airscrews developed by the Hamilton Standard division of United Aircraft. It is shown fitted to a Pratt and Whitney T34 turboprop (about 5,500 h.p.) mounted in the nose of a B-17 Fortress. The United Aircraft Corporation are one of the few organizations in America prepared to back the turboprop in public; the airlines appear still to be undecided.

Earliest Radio

AT the request of the Science Museum, the Marconi Company have provided a working replica of the apparatus used by Marconi in his early experiments. It consists of a spark transmitter, coherer receiver and morse inker.

Curiouser and Curiouser

On January 10th the Short S.B.5 adjustable-wing research aircraft first flew in its third configuration, with 60 deg of sweep and a low tailplane. The horizontal tail consists of conventional elevators with large tabs and a delta tailplane with a wide range of angular movement, the whole being attached under the rear fuselage. A large triangular portion of each wing-root leading edge is also modified with considerable fixed droop. Later the S.B.5 will receive a new wing with 69 deg sweep.

Danish Award for Neville Duke

YESTERDAY, January 14th, at a Londonderry House ceremony, S/L. Neville Duke was due to receive the Royal Danish Aero Club's golden plaque; the presentation was to be made on behalf of the Club by Mr. Vagn Christensen, general manager of Scandinavian Airlines. S/L. Duke recently demonstrated the Hawker Hunter at Kastrup, Copenhagen.

All But

MR. H. B. SHOWELL, who began his return business-trip from Australia to England in his Auster Aiglet G-AMRL on December 17th, returned to his Norfolk fruit farm last Sunday; but he was forced to complete the last lap by airline, for he experienced an engine seizure, it is reported, shortly after taking off from Naples. He got back to the airfield, and left the Auster there; he intends to collect it when a new engine has been installed. Mr. Showell made the outward trip, last autumn, in an overall time of 25 days and flying time of about 150 hours.

Target Practice?

IT was disclosed last week that a DC-3 of Eagle Aviation, Ltd., had been fired on by an unidentified fighter while on a journey from Belgrade to Blackbushe on December 31st after delivering a cargo of pigs to the Yugoslav Government. The incident occurred at a height of 10,000ft near the Yugoslav frontier; the fighter made one attack, whereupon the DC-3 pilot promptly and successfully sought cloud cover. The British Embassy in Belgrade said later, after enquiries, that the fighter was clearly not a Yugoslav aircraft.

New I.A.S. President

ELECTED president of the Institute of the Aeronautical Sciences for 1954 is Mr. John Leland Attwood, president of North American Aviation, Inc.

C.D. Aircraft

A SCHEME for mobilizing Canada's 2,000-odd light aircraft as a civil defence force has been outlined by Mr. R. N. Redmayne, manager of the Air Industries and Transport Association.

Crash Rescue Award

THE QUEEN has approved the award of the George Medal to two Canadians, A. R. Decuyper, aged 36, and R. T. Waters, aged 14. When a Lancaster crashed near R.C.A.F. station Comox, B.C., on November 24th, 1952, the man and the boy ran to the burning wreck and freed the pilot and co-pilot. The fuel tanks blew up while they were extricating the co-pilot.

Patrick Johnson joins Solar

FOLLOWING his retirement from the Board of Power Jets, Ltd. (as recorded in these pages a fortnight ago), Mr. Patrick Johnson is to develop the European interests of Solar Aircraft Co., the well-known Californian makers of gas-turbine components. He will remain free to serve the various British organizations and committees of which he is a member, and to act as adviser to Power Jets and others. He leaves for America at the end of this month and will return to open a London office in the spring.

H.D.A. Acquisition

TWO sheet-aluminium mills in South Wales—Wern Works, Briton Ferry, and Byass Works, Port Talbot, formerly owned by Richard Thomas and Baldwins, Ltd.—have been acquired by High Duty Alloys, Ltd., of Slough. Famed for its Hiduminium alloys, this member of the Hawker Siddeley Group will thus have its resources further strengthened.

Instruments on Exhibition

THE Physical Society is to hold its annual exhibition of scientific instruments and apparatus from April 8th to April 13th. Imperial College, South Kensington, will be the venue.

Condensed History

MAINLY consisting of photographs, of which there are 45, an excellent little summary of aeronautical history has been published by the Science Museum, South Kensington, under the title *The Conquest of the Air*. The booklet is obtainable at 1s (postage 2d) from the Museum or from branches of H.M. Stationery Office.

R.S.A. Prize Competition

DETAILS of three 1954 endowed-prize competitions are issued by the Royal Society of Arts. They concern the Benjamin Shaw Prize for Industrial Safety, Fothergill Prize for Fire-prevention or Fire-fighting, and Howard Prize for Mechanical Motive Power. Details are obtainable from the Society at John Adam Street, London, W.C.2.

CONTRACTOR AND CUSTOMER: Photographed last week in the Willesden factory of Rotax, Ltd., during the visit of M.o.S. officials referred to on page 59 of this issue (left to right): Mr. E. R. Legg, Rotax service director; Mr. G. M. P. Myers, private secretary to Mr. A. R. W. Low; Mr. C. H. Dutton, vice-chairman, Rotax; Mr. A. R. W. Low, Parliamentary Secretary to the Ministry of Supply; Mr. A. B. Waring, chairman of Joseph Lucas (Industries), Ltd.; Capt. M. Luby, Rotax director and general manager; Mr. K. F. Brown, Rotax finance director; and Mr. R. H. Woodall, Rotax engineering director.

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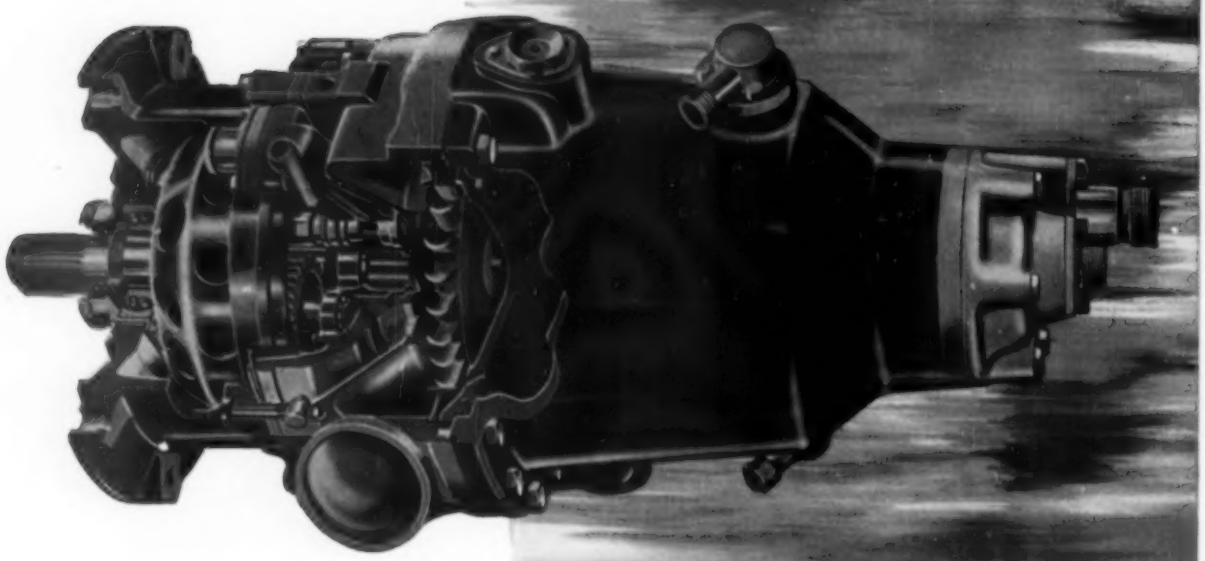

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A35

SABRES AND FURIES

Continuing Development of a Famous American Fighter Line

NO regular reader will have forgotten our issue of January 30th last year, in which the assistant editor presented the first full history of the North American F-86 Sabre to that time, together with exclusive detailed drawings (which have since been reproduced in journals throughout the world). This issue was principally concerned with the F-86E, the second version to go into production at Los Angeles and also licence-built by Canadair.

Since then the story of the Sabre—or Sabrejet, as it threatens to become popularly known—has been continued by several new variants. In these pages we bring the reader up-to-date in order that the pattern of development of what is still the most important fighter in service in the western world may be followed accurately.

The Sabre has been exceedingly fortunate in that it appeared at the right time, and every production variant has been rewarded by very-large-scale manufacture, with consequent advantages in the matter of spares provision, interchangeability and cost per unit. Actual production has, in fact, been approximately 100 per month for three years past. The aircraft has also gained by being able to draw upon a second line of manufacturers of new materials and components which are denied to products from other countries.

The following is an account of the various types of Sabre as they exist at present, after years of air combat, dive-bombing, top cover, sonic banging, deck-landing and generally rough usage in all parts of the world.

F-86A. Last year North American Aviation's Special Modifications Center at Fresno was "re-vitalizing" large numbers of these aircraft, some of which were five years old. Each was completely rebuilt and fitted with an up-rated General Electric J47 turbojet and the latest radar and armament systems. It was not, however, given the all-flying tail.

F-86D (*preceded in production by the E sub-type*). At first glance, the D appears to differ little from other Sabres, except for its revised nose. Actually, it is completely different from all other members of the Sabre family and is probably the most interesting.

The history of the D starts in 1947, when the U.S.A.F. staff realized that the outstanding performance of even the earliest F-86s offered promise for development of an efficient all-weather fighter. It soon became evident that a second cockpit could not be provided without running foul of the air duct and fuselage tankage, and thoughts gradually turned to the unprecedented concept of an all-weather intercepter controlled by one man.

In bringing this scheme to fruition, North American were forced to do far more work than they originally expected; development has taken several years and even today the D is the most expensive of all the F-86s with a capital cost exceeding 400,000 dollars, exclusive of spares. On the other hand, the work in the field of automatic control is paying off in later projects.

The basis of the D is a powerful interception radar beneath a large nose-cap, the set being similar to that carried by the two-seat Scorpion and Starfire and bearing a resemblance to that of the D.H. Venom N.F.3 and Armstrong Whitworth Meteor N.F.13.

Associated with this set is the Hughes intercepter fire-control system, which is a nightmare of electronics, alleged to contain 15,000 parts and over 200 valves. The Hughes company, who have over 12,000 employees engaged solely on electronic work of this nature, eventually eliminated the basic faults from this most complex of all airborne systems, while making it ever lighter and more compact. We are told that today it fits into "only 35 boxes." Apart from the F-86D, the equipment is carried by the F-89D, F-94C, F2H-4 and Avro Canada CF-100-4. Later developments include electro-mechanical coupling between the fire-control and the autopilot to provide genuine lock-on characteristics. This arrangement, with which the fighter follows its target automatically, is being introduced as a retrospective modification on the Ds now in squadron service.

With this automatic fire-control the pilot's task is principally that of monitoring the operation of the equipment on board, with his eyes fixed on the large tube-face in the centre of his instrument panel. In spite of the automaticity of the aircraft, the pilot has too much to do to keep any sort of watch on engine behaviour, and aircraft of this nature are too valuable to lose through misuse of the power-plant. To meet this unique case, the General Electric company were forced to develop a complex engine control in parallel with the development of a new variant of the J47 which was at that time the standard Sabre engine.

The decision had early been taken to develop an afterburner to improve the D's climb and to permit operation at the unavoidably increasing weight of the new fighter. In 1950, after three years' development, the first of the new engines—the J47-GE-17—was run at full power on the test-bed; reheat adds 50 per cent to the basic thrust, the actual figure achieved being 7,700 lb.

At the same time, the electronic control system was added, which, according to the position of the pilot's single power lever (in conformity with U.S.A.F. jet practice this is termed the thrust selector and is graduated in percentage of the maximum thrust) starts, runs up, and fixes the power of the main engine and brings in the afterburner with the correct fuel flow and jet nozzle area automatically. The entire behaviour of the engine and afterburner is correlated to maintain optimum efficiency and correct temperatures throughout, in face of the most ham-fisted movement of the cockpit lever.

The system weighs 123 lb and contains 40 valves. The main unit, comprising the main- and reheat fuel amplifiers, is supplied with signals from the tachometer/generator and amplidyne, compressor inlet temperature, compressor delivery pressure and turbine discharge temperature. The amplifiers translate this information into electrical signals which govern the main- and reheat fuel valves and the single electric actuator which positions the two jet-nozzle eyelids *via* mechanical linkage.

Early troubles occurred during transient conditions, and quick-response thermocouples had to be developed to permit rapid power changes. The first of these automatic engine controls was packed in a number of pressurized cases, but the 200 deg F ambient temperature caused a prohibitive failure rate with the valves then in use. The present system employs new electronic valves capable of operation in rarefied atmospheres, and they have permitted the use of a ventilated case which allows the unit to run cooler and saves 40 lb in weight. Altogether, this typically

Features to study in this view of an F-86D are the radome, intake configuration, landing lamp location, retractable rocket tray and canopy action. The F-86D, which has held a number of world speed records, is in service with the U.S.A.F. Air Defense Command.

SABRES AND FURIES . . .

American engine control relieves the pilot of mental worry in critical periods and performs an essential operational function; it is therefore no luxury, but a great combat advantage. No doubt all fighter pilots would like one, but it may be noted that the -17 is the only version of the J47 which has not achieved a 1,200-hour overhaul period.

The F-86D's flying controls are of the irreversible, powered type, as on the earlier E, but they are actuated by a Lear F-5 lightweight autopilot. Inserted in the control system is a damping unit which anticipates and measures the rate of deviation from the established heading of the aircraft and applies corrective forces through a servo actuator. With rocket armament, yawing has to be reduced to a minimum; pitching movements are also undesirable and North American put a metering valve in the circuit to the horizontal tail to reduce response to small stick-movements. The latter caused trouble, which has now been cured. Other equipment includes the vertical-gyro indicator, Zero Reader and a complete I.L.S. installation.

The armament of the D consists of 24 folding-fin unguided rockets carried in a launcher which is extended hydraulically by the fire-control circuit at the appropriate range. The missiles are rippled away electrically in a pre-determined sequence; their velocity relative to the aircraft is approximately 100 m.p.h. as the tail leaves the launcher and about 500 m.p.h. when passing the fighter's nose. It is essential that such missiles should follow a path governed solely by the direction in which the fighter is pointing at the moment of release and not by the relative wind, which varies with angle of attack and yaw. For this reason, the fins remain folded until the rockets are clear of the fighter, so that weathercocking in the initial stages is reduced almost to zero. Furthermore, the high air-speed of the missiles carries them rapidly past the Sabre's air intake, so that the fighter's engine swallows little of the rocket exhaust. The warheads are set to explode at about 7,000ft range; and their effectiveness is underlined by the fact that, last year, a Boeing DB-17 and crew was shot into the Gulf of Mexico by a single accidental hit from a rocket fired by an F-86D from Eglin A.F.B. which mistook the Fortress for the radio-controlled target which it was directing.

The airframe of the D is dimensionally larger than that of previous Sabres, particularly in the fuselage. The large tail-plane has no dihedral, and the fin is bigger and of revised outline. The wing of the D is stronger than the earlier Sabre's, but has the same area and retains the leading-edge slats. The canopy is of the new clamshell pattern, hinged at the rear. This arrangement is stronger and permits higher indicated air-speeds and jettisons better. Radio antennæ are sealed around the roof of the canopy.

New structural features of the D include the radome construction, which is a Hexcel glass-fabric honeycomb built up in 13 orange-peel sections and central cap. The wing trailing-edges and other parts, such as access doors, are stabilized by an aluminium honeycomb filling with ¼in cell size. New materials have been necessitated by the afterburning engine, of which by far the most important is the unprecedented use of 600 lb of titanium in each airframe. Earlier Sabres included a certain amount of 18-8 stainless steel in the hot rear-fuselage section, and the advent of the afterburner would have required additional stainless steel of prohibitive weight. The North American Company have much experience of titanium fabrication, although the F-86D represents the biggest application so far. Hot and cold forming is used plus, especially, stretching. Most of the rear-fuselage members of the D have a big radius, so plastic deformation is necessary over the entire part to obviate spring-back. Around the engine itself much of the structure is made of the new Armco 17-7 PH stainless steel.

The U.S.A.F. now have a number of Erco F-86D simulators which involve 16 equipment racks and an air-conditioned room for instructors. Two of the latter are required, one to handle regular flight problems and radio aids, and the other to monitor radar interception techniques.

F-86E. This type preceded the D in production and introduced the all-flying tail; large numbers were built in California, and by Canadair at Montreal, and a batch of Canadian-built Es was supplied to the U.S.A.F. a year ago. The two fighter/interceptor wings then operating in Korea experienced an acute shortage of aircraft at that time and 60 Canadair-built Es were rushed to the Special Modifications Center, where the latest types of combat gear were fitted, preparatory to shipping the machines across the Pacific on a carrier. Canadian-built E's are known as Sabre F.4 in the R.A.F.

F-86EO. This is a designation given to the Canadair-built aircraft fitted with the Avro Orenda turbojet of over 6,000 lb thrust. The Orenda was test flown in an early F-86A—Dick Johnson's world record breaker, we believe—and this aircraft was invaluable not only in proving the installation, but also in permitting the development of the engine at greater speeds and altitudes than Avro Canada's Lancaster could accomplish.

The Orenda fitted comfortably in the fuselage, but revision of the mounting lugs and associated structure was necessary. The duct and tail-pipe of the EO Sabre are of the same size as those on the J47-powered machines, although there is a requirement for a Sabre powered with a reheat Orenda which will no doubt have a more bulky rear fuselage. A Canadair-built fuselage was flown to the Solar company in California some 18 months ago for afterburner experiments. Production EOs are now just beginning to come off the Canadair lines (Canadair Sabres numbered from 791 onwards) and deliveries are being made to the R.C.A.F. and to the R.A.F. in Fighter Command and in Europe. They are fitted with the "6-3" leading edge—described below, on the F-86F—and are known as the Sabre F.5.

F-86F. Still in large-scale production, this is a re-designed "basic" Sabre with a slightly revised lighter structure, and a new mark of J47 turbojet. But the most important change is the provision of an under-wing bomb load, and large numbers of Fs have been supplied to U.S.A.F. fighter/bomber wings.

The under-wing tank pylons have been moved outboard to make room for bomb shackles and rocket rails, and other modifications include the armour plating of the area surrounding the all-flying tail actuator, and a re-running of the hydraulic system. Originally, both main and emergency hydraulic lines ran together at several points, but in the F they are widely separated, so reducing the chance of complete failure from battle damage. The engine of the F is the General Electric J47-GE-27 which, at 5,800/6,000 lb thrust, offers an increase of some 800 lb on the GE-13.

The present offensive load consists of two bombs of 500 or 1,000 lb size, but it is hoped to increase the permissible number of weapons to four by moving the tanks still further towards the wing-tips. Objections are the rearward shift of c.g. and the onset of undesirable tank-jettison characteristics, which require drastic treatment. Other troubles experienced in Korea included: airframe damage from whipping bomb-arming leads (which are now dropped with the bomb); stripping of bomb-pylon threads owing to frequent conversion of the aircraft from fighter/bomber to fighter/interceptor roles; carboning of liquidometer points owing to high-altitude arcing (necessitating removal of the leading edge); and reported engine surging, which may be false indication stemming from malfunctioning of the fuel regulator.

A new bomb-aiming device developed by North American has, during the past few months, been retrospectively fitted in all fighter/bomber wings equipped with the F. The equipment consists of two "black boxes," installed in the field, readily serviced, and permitting manual control of the "pips" on the sight with which the pilot can make faster adjustments to the sight before peeling off for a dive attack. It also cages the sight. Originally, the pips could disappear from view following any unexpected swerve during the dive, such as might have been required to avoid an accompanying aircraft.

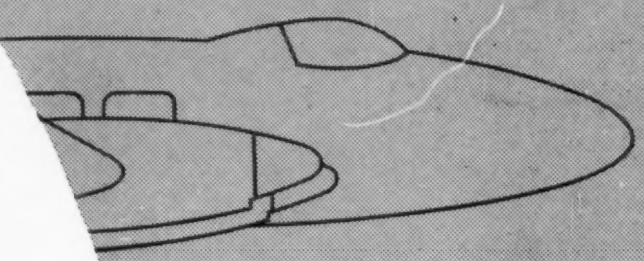
The sight fitted to the F is the new A-4, which is giving accurate results and is more reliable and easier to maintain than the A-1 radar sight used in combat on earlier Sabres. A major re-design of the system now houses all the components in easily removed packages. For dive-bombing, the sight is switched to "rocket," the attack being made at 70 deg. It is advantageous both from the point of view of accuracy and penetration that the terminal velocity of the F with tanks on is very near to the critical velocity of the bombs used. Armament remains six 0.5in guns.

A new "gimmick" that undoubtedly improved the fighting qualities of the Sabre (particularly the F) during the closing months of the Korean war is what has become known as the 6-3 leading edge. To understand the implication of this modification, attention should be turned to the shortcomings of the earlier Sabres in air combat. Although all Sabres can turn very rapidly at high speeds, it was not previously possible to use the permissible maximum rate of turn without the onset of buffeting and the risk

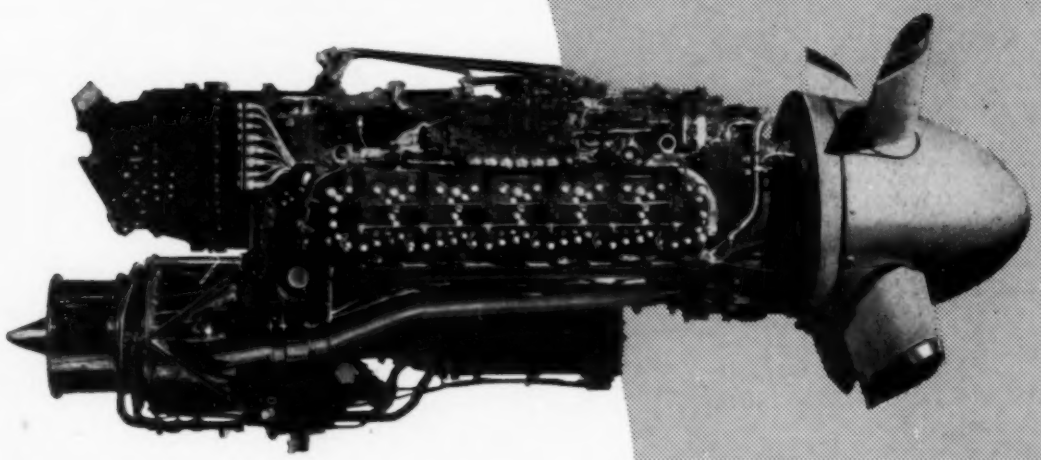
F-86Fs of the U.S.A.F.'s 84th Fighter/Intercepter Wing at Yuma County Airport, Arizona, for the first annual gunnery meet of the American Air Defence Command.

Nomad

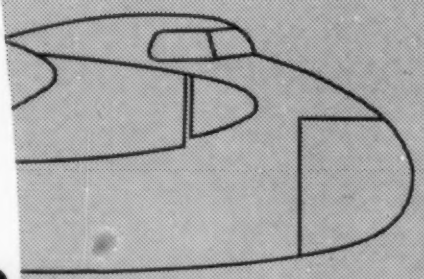
Take off rating 3,135 e.h.p.
Dry weight 3,580 lb.
Specific consumption over a wide range of altitudes and cruising speeds lies between 0.33 and 0.35 lb/e.h.p./hr.



INTER-CONTINENT



Napier aero engines are capable of exercising a great influence on the economics of air transport. Illustrated is the Nomad, at its best in installations designed for extreme range and for operation over widely varying altitudes, where its flexibility and extraordinary economy show to great advantage.



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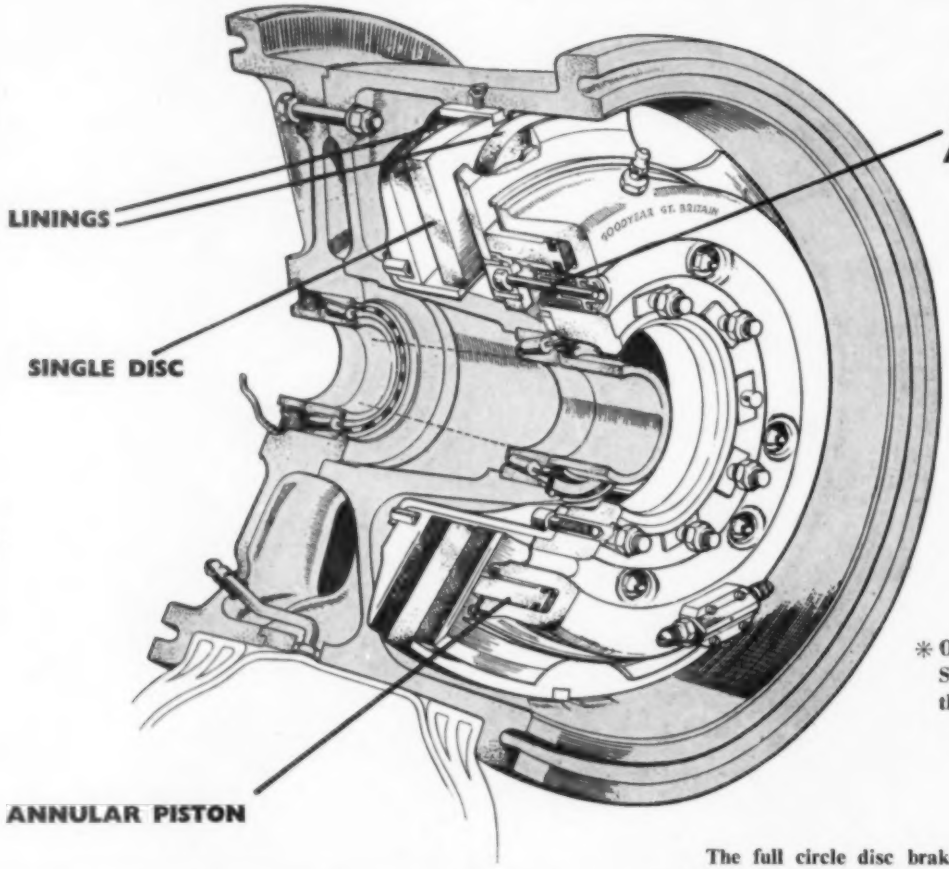
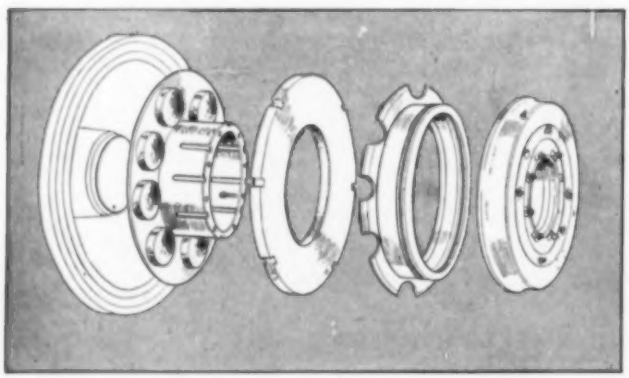


* Only Goodyear provide Single Disc brakes for the 'Viscount'.



Exploded view of the Full Circle Disc Brake

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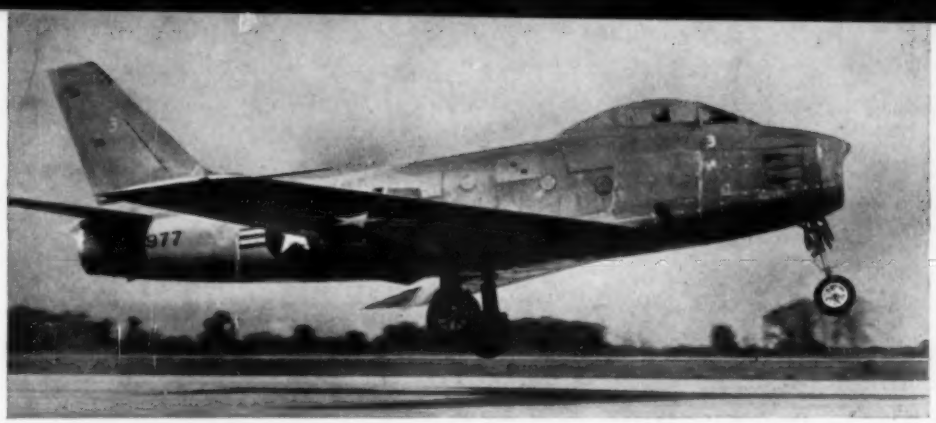
SABRES AND FURIES . . .



The F-86H, as depicted, has the extended leading edge and is powered with the General Electric J73 turbojet. Armament is six 0.5in guns.

of pulling out the large leading-edge slats. This resulted in the full potentialities of the airframe not being used. George Welch, the North American test pilot, is credited with the 6-3 modification, which involves the removal of the slats and the addition of a new, sharper leading-edge which increases the chord by 6in at the root and 3in at the tip—hence the name. A small (35in by 5in) fence is added above the wing at about 70 per cent span.

The new wing offers a slight improvement in all-round performance and, in particular, it is possible to "pull more gs" before buffeting; the actual increase is a gain of 1.5 g at Mach 0.92 at 30,000ft. With the new leading edge, the F is claimed to have a definite advantage over the Mig-15 at all altitudes. The penalty is a higher stalling speed and some sloppiness at low air speeds. A stall buffet commences at 120 kt with flaps down, followed by some yawing and rolling at 115 kt, the aircraft eventually dropping off on one wing at 105 kt. As a result, pilots now fly wider and faster landing patterns, holding speed above 150 kt on the final, and exercising caution on turns. The touch-down speed is increased by 10 kt to a minimum of 120. Modification kits embodying the new leading edge were shipped to Korea and all current F production has the new wing. The aircraft is still being built at Columbus and Inglewood, although it has been cut back considerably in recent months. A few have been modified as two-seat trainers. The trainer variant—the prototype of which flew last week—has duplicated tandem cockpits. Airframe modifications include the mounting of the wing sight further forward and an additional 63 ins of forward fuselage.

F-86H. A major revision in all parts of the E produced this sub-type, which in comparison is bigger, bulkier, heavier, stronger and nearly twice as powerful. A most important change is the switch to the General Electric J73-GE-3 turbojet, this being the company's latest production engine.

The new engine retains a 12-stage compressor, but has ten combustion-chambers arranged in cannular fashion and two turbine stages; the dry static thrust rating is 9,200 lb. The J73 has been specially designed so that its mounting points will fit any installation designed for the J47, the only revision necessary being in the fuel, power and control lines, and a general strengthening of the fuselage to take the extra thrust. The mass-flow of the J73 is of the order of 170 lb/min, and this required considerable enlargement of the intake duct.

Among the new structural features of the H is a unique grid which lies under the skin of the wing. This takes the place of the former rather complex double-skin sandwich over the wing-tank bay and reduces the number of parts employed by 285 (presumably in each wing). The grid starts as a thick slab of 75 S-O alloy, which is skin-milled to fine limits. The slab is then routed to form a rectangular-celled grid 116in by 40in, weighing 100 lb. The difficult process of forming the grid to the profile of the wing is accomplished by heating it in a furnace and then rapidly transferring it to a 7,000-ton forming press between the matched dies of which the grid is quenched in four seconds. This removes internal stress and there is no spring-back.

Other changes include a high tailplane without dihedral, a clamshell canopy, bigger cockpit with a new pattern of ejection seat, new landing gear to take the increased weight, and improved suspension of all types of underwing stores. Actually, the big thrust increase is largely absorbed in propelling this heavier aircraft, but even at over 20,000 lb, with full offensive load, the H has a better performance than the F. Armament is unchanged, and the type is in full production at Columbus for use principally as a ground-attack fighter/bomber.

F-86K. This is a slightly altered variant of the D, to be built in Italy under the M.S.A. off-shore programme. Fiat is the principal contractor, with orders worth $20m; it is reported that this finances a first run of fifty aircraft.

The first Ks will almost certainly be assembled in Italy from North American-built components, the first shipments of which have arrived. Eventually the aircraft will be entirely of Italian manufacture. A telling omission from the K will be the Hughes intercepter fire-control, which will be replaced by simple A.I. radar as carried by British night-fighters. Another noteworthy change is that the rockets of the F-86D have been replaced by four 20 mm guns. American reports that the Rolls-Royce Avon RA.7R is being considered as a possible power-plant are not confirmed. It may be noted that the allocation of the U.S.A.F. variant-letter "K" signfies that these aircraft may be used by the U.S.A.F. as well as by other NATO forces. Production tooling is under way and the type should be in service within 18 months.

Commonwealth CA-26. It is several years since the Australian Government decided that the Sabre was the best available fighter with which to re-equip the R.A.A.F. The eventual programme concerns the F, re-designed to take an Avon RA.7. The new fighter, known as the Commonwealth CA-26 Sabre, is now coming off the assembly line at a new plant at Melbourne. The first aircraft, which carried a British prototype marking, flew from the Avalon airfield last summer. The initial batch of CA-26s has been built largely with components supplied by North American, who have also contributed many drawings and specialized tools. Later aircraft are all-Australian, as are the Commonwealth-built RA.7Rs manufactured near Melbourne under Rolls-Royce licence.

The Avon has necessitated ducting nearly as big as that of the F-86H and, since Rolls-Royce could hardly anticipate this installation, considerable revision has been required in the engine-bay. Equipment is largely American, although some is of British or Australian origin. A major change is the adoption of a 30mm cannon (type unspecified) to replace the three half-inch weapons on each side. The new guns are mounted half-way down the cockpit wall, firing approximately in line with the aircraft c.g. The barrels cannot be of excessive length, for the ammunition tanks are in roughly the same positions as on the American machine. The CA-26 is probably the first aircraft armed with guns of this calibre to go into squadron service since the Me 262. The performance of the Avon-Sabre possibly exceeds that of all other F-86s.

FJ-2 Fury. The first jet aircraft ever designed as a carrier-based fighter was the North American FJ-1 Fury, which first flew in 1946. The small number built were withdrawn from service in the summer of last year, but the type is worth remembering as the progenitor of the entire Sabre series. About 1951, the U.S. Navy Bureau of Aeronautics accepted a fact which must have occurred to them years before, namely, that the swept-wing Sabre could in turn be used as the basis for a world-beating carrier fighter. "Navalizing" was rapidly undertaken, and the XFJ-2 Fury (the designation should be F2J signifying a new design) flew in February, 1952. It was a rebuilt F-86E. The production FJ-2 began to appear last winter.

The production Fury is a completely revised aircraft greatly resembling the E Sabre, but able to take an under-wing offensive load. Aerodynamic features include an all-flying tail and a slatted wing which folds upwards hydraulically. A catapult spool lies in the belly, while the hook is of the A-frame type, faired absolutely flush under the rear fuselage.

Catapult take-offs from a carrier accelerator require a high angle of attack, and this feature, coupled with the necessity of opposing the pitching moment from the catapult bridle, demand an unusually lengthy nose undercarriage. That of the FJ-2 is normally very similar to that of the F-86E but, for both catapulting and deck-landing, it can be extended hydraulically a distance of some two feet. The legs of the FJ-2 are all stressed to the rate of descent required by the U.S. Navy which, we believe, is 18ft/sec.

The armament is also changed to the four 20 mm standard for U.S.N. fighters. The new guns are mounted in the usual manner with considerable horizontal stagger. The gunsight is a new Navy model which protrudes slightly in a fairing in front of the windscreen. Production Furies are equipped with a fire-control system for rocket firing, specially developed for the aircraft by the Bureau of Ordnance at Inyokern. The latter system includes probes which feed angle-of-attack and yaw information to a fire-control computor which permits the rockets (presumably air-to-ground) to be launched only when the relative wind around the aircraft is correct. Unlike the weapons of the

SABRES AND FURIES...

The FJ-2 Fury of the U.S. Marine Corps. Visible in this photograph are the stowed arrester hook, air brakes, large drop tanks and ports for two of the four 20 mm guns.

F-86D, these missiles have standard fixed fins and, therefore, weathercock immediately the release pins are actuated.

The Fury cockpit houses a Navy-furnished ejection seat, and several new instruments. Among the latter are the Sperry S.2 remote gyro compass, feeding remote-magnetic indicators which combine A.D.F. with magnetic heading. The cockpit is conditioned by a Hamilton Standard air-turbine refrigeration circuit.

The structure is very different from that of the land-based Sabre and it is evident that the 100 lb of titanium in each Fury has been adopted to resist corrosion and to provide increased strength and wear resistance, as well as to combat the effects of high temperatures. Some parts of the Fury airframe experience ambient temperatures of the order of 250 deg F; such parts include the engine bay frames and bulkheads, which are made of Remington Crucible 130-A alloy, and a number of shrouds of commercially pure titanium. Commercially pure titanium is also used on the ammunition tracks for the cannon, and in the flap rubbing-strips, the latter being subject to corrosion. The revised wing-structure involves the same type of one-piece grid as is used on the F-86H; in the FJ-2 this is stated to reduce the number of parts in each wing by 214.

New equipment includes an Air Associates flap drive, which has five limit-switches and can stop in any position. The system consists of two actuators, two flexible shafts and an "H" drive. The fuel system has been modified to admit a wing probe for flight refuelling, while the tanks themselves now carry Carter relief valves actuated by a pressure difference of 0.75 lb/sq in, and capable of passing 100 cu ft of air a minute.

FJ-2 Furies are now gradually being "phased out" of production at Columbus, Ohio, after delivery of several hundred to the U.S. Navy and Marine Corps. Many of these aircraft have been unpainted and delivered with a corrosion-resistant anodized finish. The under-wing tanks of most FJ-2s are of an unusual configuration, and carry twin fins (see photograph above).

FJ-3 Fury. Latest of the carrier-based Furies, this machine differs from all other Sabres in having a Sapphire as the power-plant. The engine is, in fact, a Wright- or Buick-built J65 (originally an Air Force sponsored engine) and its installation has again required structural revision and a bigger intake duct.

The FJ-3 protoype first flew in the summer of this year, Bill Ingram carrying out most of the initial testing. The Sapphire confers a great increase in all-round performance, especially in rate of climb, although the FJ-3 is rather heavier (and slightly larger) than the FJ-2. It does, in fact, correspond roughly to the F-86H, although it is a completely independent development. The armament consists of four cannon and a heavy under-wing load. The FJ-3 also has an improved Navy gunsight, and additional navigation equipment. Like the FJ-2, it has been designed for easy maintenance, and the entire airframe is covered with access doors. It is now succeeding the FJ-2 in production at Columbus.

Super Sabre. Succeeding the F-86 Sabre in production is the mighty F-100A Super Sabre. This completely new design was fully discussed in our issue of November 6th last. In spite of an unfortunate strike, production of the F-100 is almost on schedule. Unconfirmed reports predict the appearance of an all-weather intercepter version of this aircraft, together with a navalized variant which has been reported to be styled FJ-4.

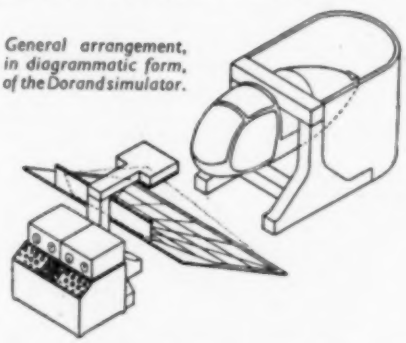
A HELICOPTER TEST-FLIGHT SIMULATOR

A NEW departure in flight simulators has been made in France: the Dorand helicopter control-testing rig. In effect a flight simulator, the device reproduces on the ground the designed control-responses of a new helicopter that has yet to be flown. It does so in the accepted manner with the aid of an electronic computor, but it has the singular characteristic of reproducing relative ground-movement visually on a screen. Calculated performance may thus be checked before flying tests begin, and the test pi'ot can also gain experience in handling a new machine before he takes it into the air.

The simulator translates into Link-trainer-like reactions the calculated characteristics of a helicopter's control system. A description in the journal *Aéro France* explains that this is achieved by an "electronic brain" into which the relevant calculations are fed and recorded. The brain receives orders (in the form of control movements) from the cockpit, integrates them with the calculations, and monitors six electric motors which thereupon accurately reproduce the dynamic responses of the aircraft. The cockpit is suspended at a point close to its centre of gravity and controlled by servo-motors in roll and pitch.

Operating through the motors, the brain also moves the visual background—a picture of the ground projected on to an inclined screen, giving the pilot presentation, in perspective, of longitudinal and lateral movement.

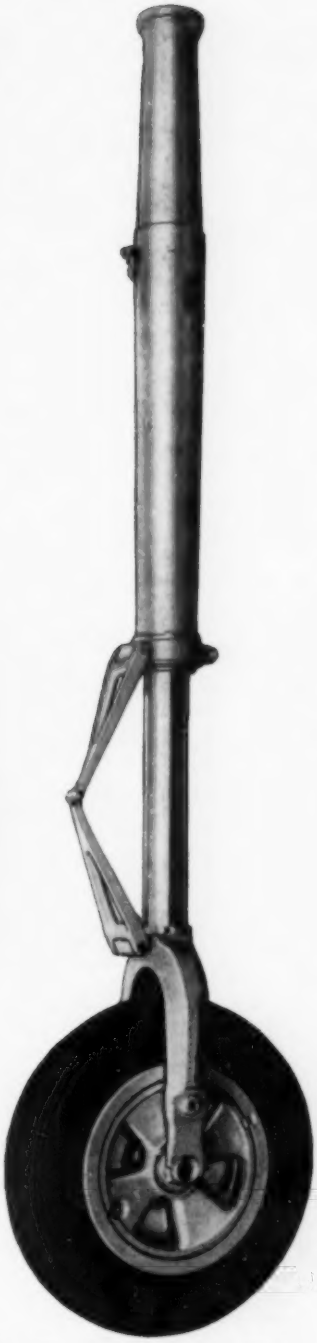
The brain deals with six variables which are mathematically represented by two differential equations and which, by the conversion of the electrical impulses into torque, cover three conditions of hovering flight: (a) longitudinal and lateral inclination of the effective rotor-disc axis in relation to fuselage axis, (b) longitudinal and lateral tilting of the fuselage, and (c) longitudinal and lateral displacement of the aircraft. Each of these variables is represented in the brain by a rotating electro-mechanical unit, consisting of a galvanometric body having a known moment of inertia (the master unit) and freedom of movement within a magnetic field; this field is produced by an inductor (the slave unit) driven by an electric motor, set to follow exactly the movements of the master unit.



General arrangement, in diagrammatic form, of the Dorand simulator.

Each of these units governs precision potentiometers. Power delivery is proportional to the movement of the magnetic units, the proportion being determined by another potentiometer, which is set according to the information previously recorded in the brain for the particular machine to be tested. The magnetic units further operate tachometer generators having a small rotational inertia. Output of these generators is proportional to the speed of movement of the magnetic unit. The proportion is here also regulated by a potentiometer pre-set according to data recorded in the brain.

The electrical impulses thus produced are fed back to the magnetic units. To these are added the output from a group of potentiometers operated by the control column in the cockpit, and the various factors in control are then reproduced in the movement of the cabin.



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AIRCRAFT INTELLIGENCE

TWO FOURS (first appearances notwithstanding) are the Douglas DC-7 (top) and the S.O.30P Bretagne. The big Douglas is powered with four Wright R-3350 Turbo Compound engines of 3,250 h.p., and the Bretagne has two Pratt and Whitney R-2800s, plus Turbomeca Palas auxiliary turbojets beneath the wings. The non-stop trans-continental version of the DC-7 weighs 122,200 lb, and the standard version 116,800 lb.

Great Britain

de Havilland Venom and Sea Venom. Contrary to information given on this page in the issue of December 25th, it is now learned from the de Havilland company that the aircraft depicted on that occasion was not fitted with ejector seats. Nor is it the intention to fit such seats to this type or to the Sea Venom F(AW).21.

Canada

de Havilland Agricultural Combination Beaver. This new version of the Beaver combines the functions of spraying, fertilizing and supply-dropping. Roles can be rapidly switched; thus an operator can conclude an insect or weed-spraying operation and convert for fertilizing or seeding in less than one hour. Conversion for supply-dropping is a matter of minutes. Removable seats are provided for a loading crew of three and are used when ferrying from base to the selected airstrip. Removal of the hopper permits conversion to the standard cabin, seating six passengers or carrying 125 cu ft of freight.

France

Training Aircraft. The present schedule for the training of French jet-pilots includes 15 hr on the Stampe S.V.4 biplane (Tiger Moth equivalent), 140 hr on the two-seat T-6 (Harvard), 45 hr of advanced flying on the Morane Saulnier M.S.472, and 45 hr on the T-33 Shooting Star jet. Since the adoption of the Fouga 170R Magister plans have been laid to modify that schedule completely, and the new programme will include 15 hr on light aircraft, 35 hr on a piston-engined two-seater, 140 hr on the Fouga Magister, and only 10 hr on the T-33.

U.S.A.

Convair RB-36D. A "substantial number" of RB-36D reconnaissance bombers will be modified by Convair's Fort Worth Division for use as flying aircraft carriers, according to *Aviation Week*. Each will carry a Republic F-84F in the bomb-bay for the delivery of nuclear weapons over ranges up to 5,000 miles.

Piasecki H-21C. No grounding action has followed the break-up of a Piasecki H-21C Workhorse helicopter during dive and pull-out tests of December 23rd. The tandem-rotor machine came in two just ahead of the engine section but the pilot baled out safely. The H-21C is the latest production version in the Workhorse series and is powered by a Wright R-1820 single-row radial of 1,425 h.p.

DOUGLAS C-124C
GLOBEMASTER II
Four Pratt and Whitney R-4360-63
Wasp Majors
Span 173ft 3in
Length 130ft 0in

A lively take-off from Schiphol Airport, Amsterdam, by the Nene-powered S.14 Mach Trainer. This aircraft first flew on October 25th last year.

FOKKER S.14 IN THE AIR

NUMBER 50 OF THE SERIES

BY THE EDITOR

THE fiftieth in this series of personal impressions of aircraft handling follows an exciting and revealing flight in a jet trainer. During sixty concentrated minutes spent at the controls I learned a lot and refreshed memories of even more. I also recaptured for a while that jet *joie de vivre* which comes to the occasional amateur who is fortunate enough to sample confidently and in comfort the freedom of the high skies.

So different are the dimensions of flight in a modern jet machine that for me the first light aircraft to figure in this series differs from the fiftieth almost as if they belonged to the first and fiftieth year of flying itself. The gap between flying a light aircraft in good weather and handling jet fighters or bombers in all weathers has become a great chasm. For this reason alone there is a requirement for a training aircraft, both docile and simple to handle yet fully equipped and lively in performance, which can bridge that gap for pilots in training. This is precisely what the Fokker S.14 Mach Trainer (to give its formal title) sets out to do —and succeeds admirably in doing.

On the particular morning of the flight I watched the gloomy weather at Schiphol get steadily worse as the aircraft was readied for take-off. But now, recalling my unfulfilled wish for clear skies, in retrospect at least, I give thanks for the very bad (but not *too* bad) conditions which resulted in a more complete and instructive experience. Jet training cannot be undertaken only in good weather; nor should it be.

This machine has some formidable competitors with both side-by-side and tandem seating but it has certain advantages over all others. It was, of course, designed as a trainer from the outset.

I was quite familiar with the S.14 Derwent but had not seen the aircraft since it became the S.14 Nene. Examination in the hangar revealed some important differences, though none was very obvious externally. A slight concave curvature on the bottom line of the rear fuselage may be noted.

To accommodate the 4in larger jet pipe of the Nene a completely new rear fuselage has been fitted from a point aft of the wing trailing-edge. Improved jet-pipe cooling airflow has also been provided. The fixed and control surfaces remain unchanged, but new lattice-type dive-brakes have been fitted in place of the earlier solid panels; they consist of three surfaces situated on the two sides and underneath the rear fuselage.

The installation of the Nene was not a difficult task, space being available and existing air intake and trunks being already large enough. Mountings were accordingly adapted and a modified accessory gearbox installed.

Other changes to be mentioned are the new instrument panel, which complies with NATO standards, and the installation of new air compressors together with greater storage capacity for the pneumatic power system. Two pumps are now fitted, giving pressure up to 3,000 lb/sq in.

Additional fuel booster pump capacity is provided for the Nene, with a 3.75-gallon recuperator. The new undercarriage, by Dowty, is not unlike that on the Hunter. Apart from looking after the increased aircraft weight the equipment itself shows a saving of about 70 lb over that first fitted. The brakes are more powerful than those on the Derwent prototype.

The S.14 Nene first flew just over two months ago, on October 25th, 1953, and will now have done about 35 hours. Principal dimensions are the same as for the Derwent version, but the normal all-up weight is 12,230 lb compared with 11,800 lb. With increased tankage, resulting from the installation of a 37.5-gallon tank in each outer wing, the max. design a.u.w. is 12,980 lb.

Royal experience of a jet trainer: Prince Bernhard of the Netherlands enters the first pilot's seat while Captain Sonderman, who is both his personal pilot and the chief test pilot of the Fokker company, stands by.

The accommodation of the fuel—all in the wings—is as follows:—

Two inner tanks (2 × 90 gal)	180	gallons
Two front outer tanks (2 × 60 gal)	120	,,
Two rear outer tanks (2 × 50 gal)	100	,,
	400	,,
Usable volume	375	,,
Two auxiliary outer wing tanks (2 × 37.5) ...	75	,,
Total capacity	450	gallons

Before the flight is described, a reminder may be given that the first production S.14 Nene is due in the autumn. A batch of twenty is being built for the Royal Netherlands Air Force, and five for Brazil, where a large number is then to be built.

Provision is made for an armament pack carrying two 20 mm guns to be fitted (or quickly detached) beneath the nose. A new moulded canopy, reinforced with Fibreglass, has also been designed.

Fokker pilots who fly the S.14 Nene are Mr. G. Sonderman, chief test pilot, who has done most of the work on the aircraft and with whom I flew; his assistant, Mr. A. P. Moll, ex-Dutch Air Force, a Meteor instructor, and still in the Auxiliary Air

Force; occasionally Mr. Bergerhaut, who since October 1st has taken over technical sales and liaison for the company; and Major "Fritz" Vyzelaar, who is Service acceptance pilot at Fokkers (and was for some time liaison pilot with Glosters). In addition to these a few Dutch pilots have had a ride and Italian and Argentinian test pilots have sampled the controls.

Having brought myself up to date on the aircraft and associated matters the time came to prepare for a flight. The machine had been signed out but was still in the hangar and the weather was obviously deteriorating. First Sonderman showed me around the cockpit. The blind-flying panels are one electrical and one suction-operated—as a guard against power-supply failure.

On each side of the cockpit are dual power and air brake levers. The power levers carry the gun-sight controls and press-to-transmit buttons. Lined up on separate panels in front of the instruments are electric switches (port) and fuses (starboard).

Both pilots can reach the levers and controls on the central pedestal; these operate wheels and flaps, hood jettisoning—which is possible with safety down to approach speeds—high- and low-pressure fuel cocks, and control locking linked with the H.P. cock. The relatively few dials are indicated in the diagram. The brake levers are found on the sticks, and both seat position and rudder reach are readily adjustable.

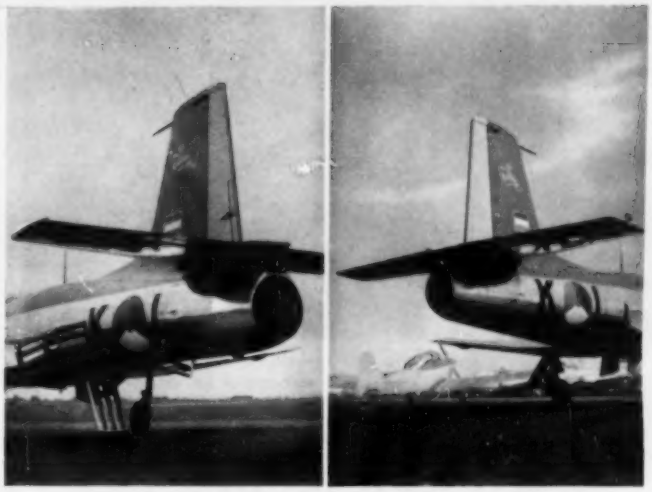
The main undercarriage selector lever has three positions: up, down, and locked. For normal operation, up and down are all that are required, but in the event of a failure, emergency operation is obtained either by gravity or with the aid of the emergency air system. The main lever is first moved to down, then the emergency system operated, finally by bringing the main lever to the full back or locked position the spring-loaded down lock pins are forced into the lock position. To raise the wheels on the ground in emergency a red emergency unlocking lever is pressed down and then the undercarriage selected up on the main lever.

Between the pilots' seats are a few other controls, namely, those for cockpit heating, screen de-icing and screen demisting, and others giving emergency oxygen. Here also are found lighting rheostats, radio volume controls, ground/flight switch and more electrics.

After the examination of the aircraft, we returned to the test pilots' offices and checked again with Meteo, only to learn that there would be no improvement until after dark and that fog was forecast for the evening. The only thing to do was to wait until the next day—or perhaps . . . How thick was this stuff, anyway? Met. didn't know? Let's get up there right away and tell them.

As the S.14 was pushed out into the gloom, the rain started.

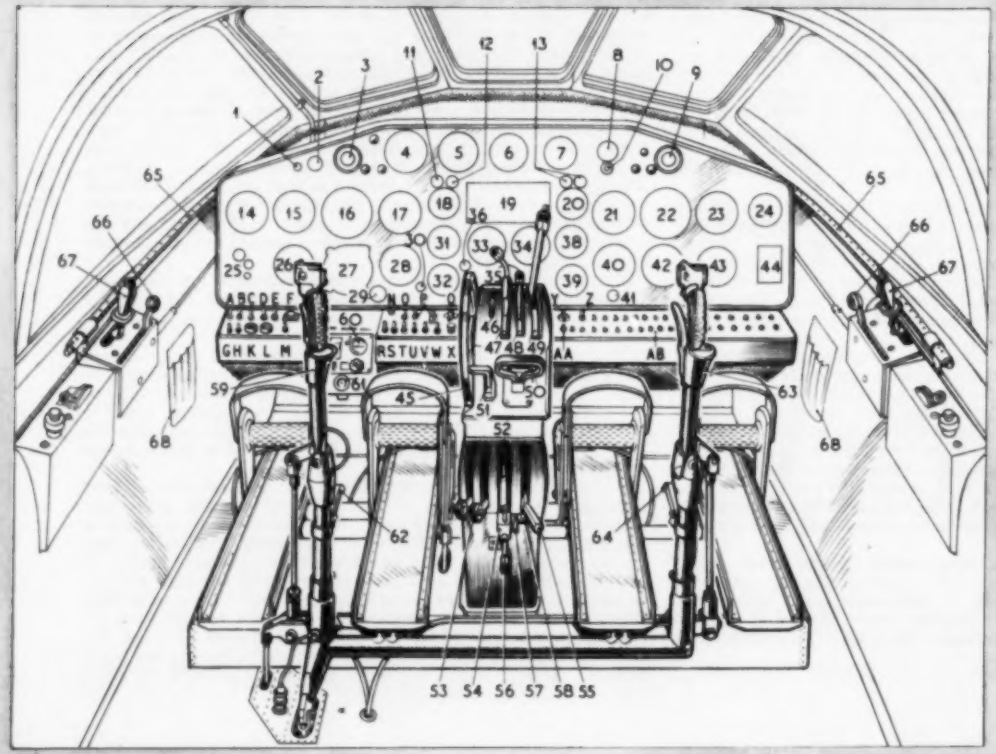
We jumped into suits, Mae Wests and then the aircraft. Chutes, dinghies, harness, and helmet were hitched up, main and emergency oxygen supplies and head sets connected, and the pins pulled out of our ejector seats. The power-operated canopy



On the left is the tail of the S.14 Nene with larger jet-pipe, modified lines, and new three-section lattice-type air brakes extended. For comparison the earlier S.14 Derwent tail is illustrated on the right.

KEY TO COCKPIT LAYOUT (1)

(1 and 2) Switch and warning light for fuel pressure, (3 and 9) Brackets for instrument panel and gun-sights, (4) Engine-speed indicator, (5) Jet-pipe temperature, (6) Radio compass, (7) u/c position indicator, (8) Rudder trim-tab indicator, (10) Rudder trim-tab switch, (11) Hood-locking warning light, (12) Flaps warning light, (13) u/c and dive-brake warning light, (14) Machmeter, (15) Air-speed indicator, (16) Gyro horizon (electric), (17) Climb indicator, (18) Oil-pressure indicator, (19) Tuner radio compass, (20) Clock, (21) Air-speed indicator, (22) Gyro horizon (vacuum) (23) Climb and dive indicator, (24) u/c emergency pressure indicator, (25) Radio controls, (26) Sensitive altimeter, (27) Gyrosyn compass, (28) Turn-and-bank indicator (electric), (29) Push-button fire-extinguisher installation, (30) Engine fire warning light, (31) Pneumatic system pressure, (32) Accelerometer, (33) Fuel contents gauge, port, (34) Fuel contents gauge, starboard, (35) Brake pressure indicator, (36) Fuel contents switch, (37) Deleted (early radio panel replaced by oxygen regulator, (38) Suction gauge, (39) Free air temperature, (40) Sensitive altimeter, (41) Static-pressure selector valve, (42) Directional gyro, (43) Turn-and-bank indicator (vacuum), (44) Engine data, (45) Elevator trim-tab control, (46) Elevator trim-tab position indicator, (47) Flap control, (48) u/c emergency control, (49) u/c control, (50) Hood jettison control, (51) u/c lock over-ride control, (52) Control pedestal, (53) L.P. fuel shut-off cocks, (54) H.P. fuel cock with re-light switch, (55) Hood locking control, (56) Control surfaces locking lever, (57) Hood operating switch, (58) Catch for hood locking control, (59 and 63) Instructor's and Pupil's control columns carrying brake levers and firing buttons, (60 and 61) Oxygen panel and regulators, (62 and 64) Rudder pedal adjustments, (65) Hot-air spray or windscreen heating, (66) Air brake controls, (67) Power levers carrying gun-sight controls and press-to-transmit buttons, (68) Map cases for both pilots. Electrical panels: (A) Oil pressure, (B) Vibrator, (C) Starter safety switch, (D and E) Booster pumps, port and starboard, (F) Starter push-button, (G) Turn and slip, (H) Navigation lights, (K and L) Fuel pressure lights, port and starboard, (M) Fuel contents, (N) Generator (power-failure light), (O) Signal light, (P) Isolating-valve switch and warning light, (Q) Landing-light switch, (R) V.H.F. switch, (S) A. D. F. switch, (T and U) Radio compass, (V) Gyro-compass and horizon, (W and X) Pitot heating and warning light, (Y) Cockpit light, (Z) Reserve switch, (AA) Intercom. muting, (AB) Fuses.



This unusual aerial of the S.14 brings out its main characteristics particularly well—large enclosure for side-by-side cockpit, low-aspect-ratio wings of generous area, and roomy fuselage. The colour scheme comprises natural metal, a dark blue fuselage top and fin, a yellow rim and flashes outlined in blue for the air intake, and yellow rudder.

FOKKER S.14 IN THE AIR . . .

moved shut and I felt rather like a trussed turkey—more so after starting-up and testing full cockpit heat. We were spared the use of g-suits and, in fact, the anti-g valve and connection at present in the cockpit will probably be omitted in production machines. This (and possibly a slight modification of the main air ducts) will give more elbow room, although I would find no fault with the space or comfort of the cockpit as it is.

Sonderman, installed in the starboard seat, came in on the intercom; I flicked down the line of switches as previously instructed. Then to start: throttle closed, H.P. cock off, L.P. cock on, pumps on, starter switches on, etc.

I did as instructed, finally pressing the starter button for two seconds. These preliminaries had so far felt more like a dress rehearsal, but as the H.P. fuel cock was moved slowly open and the Nene came obediently to life, it was obvious that action had begun.

I recalled that, in the preliminary edition of pilots' notes which had been prepared, there were several rather formidable check lists for use before entering, starting-up or taxying. So far as I can remember—for I did not take any notes—the Nene idled at about 2,500 r.p.m.

There are a number of warning lights dotted around the panel and I have since been wondering how many could reasonably be fitted before a pilot became confused by them rather than appreciate the reminders they give. A red light blinks at you if you open up the throttle before locking the canopy, two more flash if the dive brakes are extended when the wheels are down. Three more red lights indicate as usual that the three wheels are unlocked, and, alternatively, three green lights that they are locked down. Should the flaps be selected up but the surfaces remain or become slightly down (less than 1 in.) then a yellow light flashes this information to the pilot. The fuel-pressure and fire-warning lights fortunately remained out.

While standing on the tarmac we checked pneumatic pressure, synchronized compasses, turned on the radio and scanned the engine dials.

But we are burning fuel, and although this S.14 Nene carries a usable 375 gallons the flight must begin. "Ready?" says Sonderman, arms folded. "Ready," I reply, folding my arms. We sit. "Off we go," says Sonderman. "O.K." I reply. We sit. He looks at me, and I realize at last that I am not to be shown how; occupying the first pilot's seat, I must do the flying. He is prepared only to act as safety pilot, to answer questions and to work the radio.

Permission to taxi was given (in English, of course) by Schiphol tower and I turned up the wicks, gingerly at first and then more and more until the Nene squealed in our ears. At last we moved slowly forward and then gathered speed quickly. When *will* I remember that bags of urge are needed to start a jet rolling and that it is convenient to keep up a fairly fast taxying speed with steady power thereafter? I checked the brakes "hamfootedly" and made the S.14 bow abruptly to port. This convinced me of their power; and some dozens of Dutch workmen, cycling or walking across the tarmac to their lunch, looked mildly apprehensive.

Dimly ahead through the large, acutely sloping screen panels I could see taxi tracks and runways. In fairness it must be added that the view from the cockpit is particularly good, and on this occasion bad light and poor visibility alone prevented us from seeing better. We had permission to prepare to take off from an intersection on the main runway.

Sonderman set the trimmers (elevators neutral, rudder a fraction right) as we taxied out, and he checked my previous checks and put the pitot-head heaters on. Cocks and pumps were on, flaps are not used, instruments working, dive brakes in, canopy locked, compasses synchronized and set. I checked my seat and straps and made sure we were getting oxygen at maximum rate.

"O.K. to line-up and take-off," said the tower. Turn 90 deg starboard at safe height after take off before climbing, were the further instructions. Ahead, lined with lights, stretched the runway. Visibility was perhaps 800 yards. The probe on the nose of the S.14 appeared so long that its tip seemed to converge with the runway centre line and, in the distance, merge into it.

I opened-up the Nene, which thrummed momentarily as it approached take-off power, and then released the brakes. The delightful surge forward was accompanied by a blast of scorching air from the demisting/de-icing ducts for the screen. It was no trouble to keep straight and no effort to drop one's eyes from the runway level through the screen to the instrument panel. A gentle backward movement of the stick and the nosewheel came off at—I think—about 75 kt and then we were all off at 105 kt with speed building up rapidly.

Lack of practice told badly at this point. I looked for the right instruments, intending to check r.p.m. and jet-pipe temperature. I reduced r.p.m., braked the wheels, changed hands on the stick, and reached for the u/c lever. I selected wheels up but could not find the dials I wanted to read. I looked out to check attitude, but we were already in wet cloud at about 500ft. Back to instruments. Attitude at all costs. Bother that left hand; we are left wing low and climbing like hell. And why are those u/c reds still on? Check air speed. What, 180 kt, and wheels supposed to be locked before exceeding 145 kt or some such figure?

Sonderman's hand hovers for the first (and only) time. Since he had changed frequency after take-off I had not heard a thing because of a deafening chatter of American accents calling for weather and approach and landing instructions in about four times as many words as necessary. Nothing for it now but to reduce speed by pulling the nose up even more. The wheels locked up at last. I caught up with events and got settled on instruments, flying with my right hand, and made the turn to starboard on to course. Climbing speed could have been steadier but stayed around the 220 kt I.A.S.

I was too hot, and my ears pinged because this S.14 is not pressurized.

At 8,000ft the rate and angle of climb seemed a little less—probably because I was getting used to it. I allowed the speed to build up to 240 kt and the climb indicator still showed over 4,000 ft/min. The best indicated climbing speeds have not, I believe, been finally settled as yet. The r.p.m. remained at 12,200 after the take-off period at 12,500. Some performance figures for climb and level flying are tabulated on page 72. Theoretically the aircraft should climb best at 290 kt T.A.S. In indicated air speed this is equivalent at 10,000ft to 245 kt; at 20,000ft to 210 kt; at 30,000ft to 180 kt; and at 40,000ft to 145 kt. During early flights of the S.14 Nene, with take-off weight of 12,600 lb (5,200 kg) and normal climbing power at 12,200 r.p.m., the time from release of brakes to 30,000ft was found to be from 12 to 14 min and to 35,000ft about 16 min. The use of full throttle to 35,000ft reduced the time to 14 min.

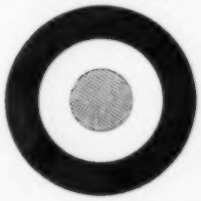
The cloud showed signs of becoming layered, and at 12,000ft we were clear. There was quite good weather to the north, but a front was moving in fast from the south. We climbed on, reducing indicated speed at 5,000ft intervals up to 35,000ft, where it was 165 kt. Here I decided to level out while I felt well, not being too sure about my sinuses at very low pressures. (Temperature at the tropopause is about −55 deg C and the density and pressure of the air are only a quarter of their ground-level values.)

I had little chance to observe the operation of the Nene, but I soon found it to be a set-and-forget power unit which carries on smoothly producing thrust and reducing the fuel tank readings.

The rules say that jet-pipe temperature must never exceed 720 deg C, but I don't remember seeing the needle above 630 deg C. The Nene made itself felt only when it was beginning to get stalled—with climb r.p.m. and very low climbing speed at 30,000ft and over. The symptoms were a slight rumbling, felt rather than heard. An increase in aircraft speed or small change in r.p.m. stopped this at once.

For a few minutes I turned the S.14 around and realized how at home I was beginning to feel. The controls are nicely harmonized and the loads are light. The ailerons feel very light at this altitude but remain effective at low speeds. Only when, later on, we dived to a high speed low down did they become heavy. At high altitude the stick force per g is very small and little effort is required to pull the S.14 into a high-speed stall from a steep turn. Warning of this stall is adequate and such that you can hold the aircraft shuddering round yet under full control. During this short playtime the r.p.m. were kept at about 11,200 and the Mach number stayed around 0.7 with indicated air-speed of about

ROYAL NAVY



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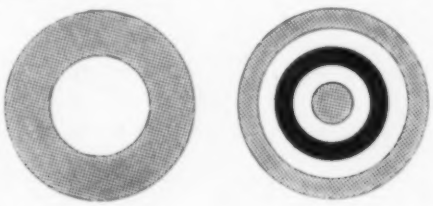

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ROUND THE CLOCK

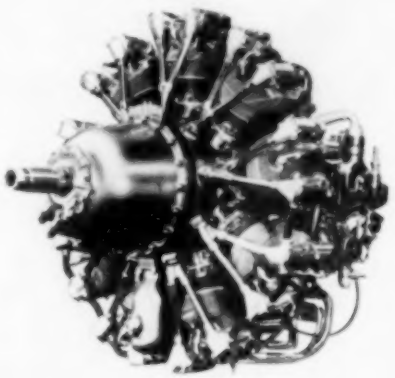
NOTEWORTHY SUCCESS OF THE LEONIDES IN INTENSIVE FLYING TRIALS

Extraordinarily rigorous and intensive flying trials have amply demonstrated the merits of the new Royal Air Force Basic Trainer, the Percival Provost T. Mk. 1 — which is powered by the 550 b.h.p. Alvis Leonides Mk. 126 Engine.

Royal Air Force pilots of the Central Flying School (Basic) at South Cerney put the first production Provosts to be delivered through what has been described as "the most gruelling treatment ever undergone by a new Royal Air Force Basic Trainer."

One thousand flying hours were logged in the first seven weeks of the trials, of which more than half was accomplished by only two aircraft. One Provost flew 21 hours 5 minutes in one 24-hour period. When the trials were completed on the 16th September, the Log Books showed 2,332 hours 10 minutes flying, with 5,757 take-offs and landings.

The Leonides engines won praise from pilots and maintenance crews throughout this arduous test, which represents a



utilisation of from two to three times the normal figure for Training Aircraft.

This gratifying success in trials of unprecedented intensity fully justifies the choice of the Alvis Leonides by the Royal Air Force to power their standard Basic Trainer.

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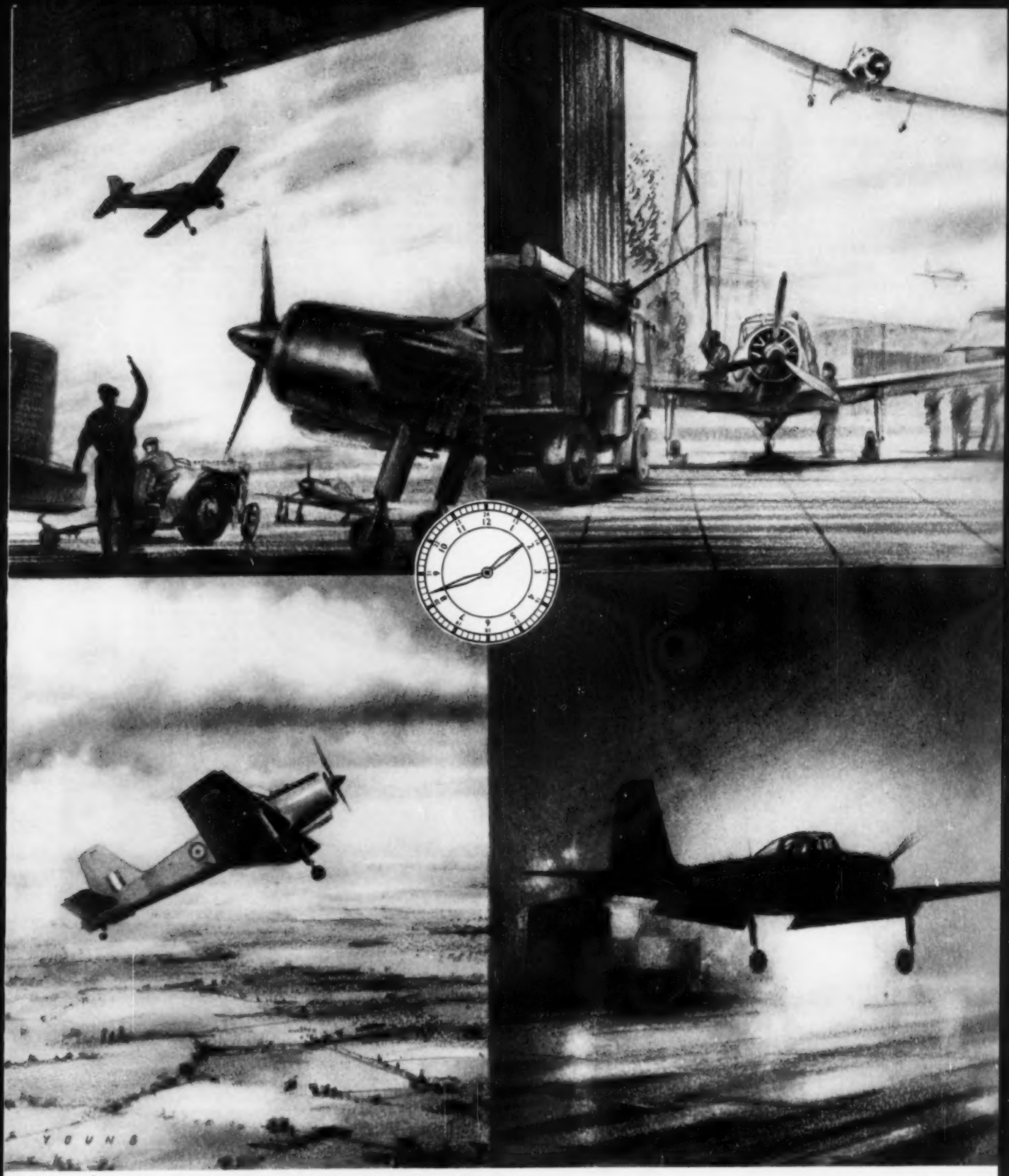

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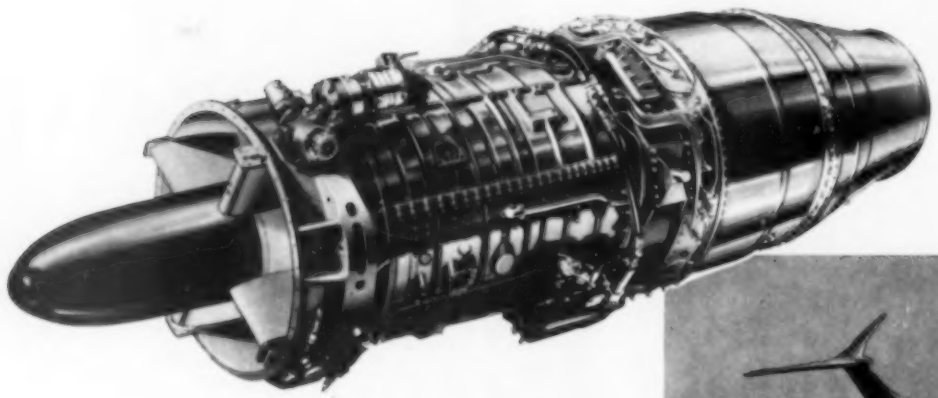
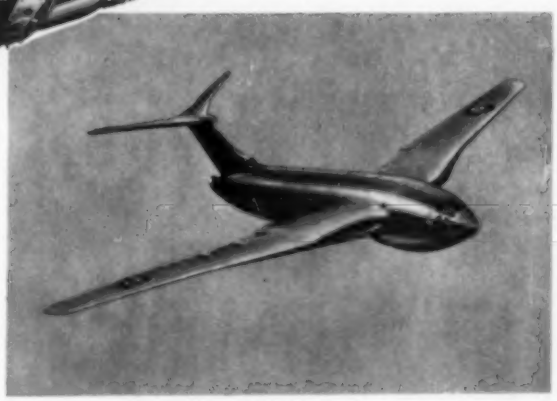
Four Sapphire turbojets power the Handley Page Victor crescent-wing bomber, now in super-priority production for the Royal Air Force . . . further evidence of the vitally important role the Sapphire is filling in equipping the air forces of the Western world.





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FOKKER S.14 IN THE AIR . . .

200 kt. With maximum cruising revs of 11,800 at 30,000ft, the Mach number is about 0.73 and the T.A.S. 280 kt. Maximum cruising speed at sea level is 422 kt.

In the unlikely event of a power failure a gliding speed of 145 kt I.A.S. should be maintained; the glide angle is such that from 10,000ft in still air 17 miles can be covered. According to figures obtained during early tests of the S.14 Nene, levels at full throttle at 20,000ft and 30,000ft gave true Mach number readings of 0.77 and 0.76 respectively.

Sonderman now suggested that I dive once or twice to experience the transonic characteristics. Frankly, I had no idea how to judge a 30 deg dive in this icy and hazy blue, nor was I sure how best to get into the dive, or what, if anything, to do about power setting. Illogically, it did not occur to me to wonder how to pull out of the dive, although I knew from the book that there is at present a "2g" limitation at over about Mach 0.8 and 4.5g between 0.75 and 0.8. On production versions of the Nene Trainer the torsional strength of the wing is to be increased to permit 4g up to Mach 0.86. The wing form remains unaltered. The thickness ratio is approximately 12 at the root, and, unexpectedly perhaps, increases to a maximum of over 14½ per cent outboard.

In the physiological sense, I was a little apprehensive at the idea of an unpressurized dive, though intrigued at the prospect of experiencing compressibility effects. Previously, flying solo, I had taken a Vampire and a Saab J.21R to the onset of mild buffeting, and then hurriedly recovered. I had also felt the same early symptoms in a Meteor and in a Canberra.

There was no purpose in hanging about, so I trimmed carefully for level cruise, built up something over Mach 0.7 on the level with 11,800 r.p.m. and then peeled over to port and, finding the rudder pretty solid, held the nose straight and dived at what must have been about 20 deg. The altimeter started to behave like a clock without its escapement and at an indicated Mach number of 0.78 the airframe began to shake gently from the back end, the probe on the nose wobbling in sympathy. This mild buffeting did not bring any trim-change that I could notice. The buffeting increased as speed built up, and at approximately Mach 0.8 I was told to operate the dive brakes and leave the elevators alone. The result was a very pronounced deceleration, a slight nose-up trim-change, and a gentle pull-out.

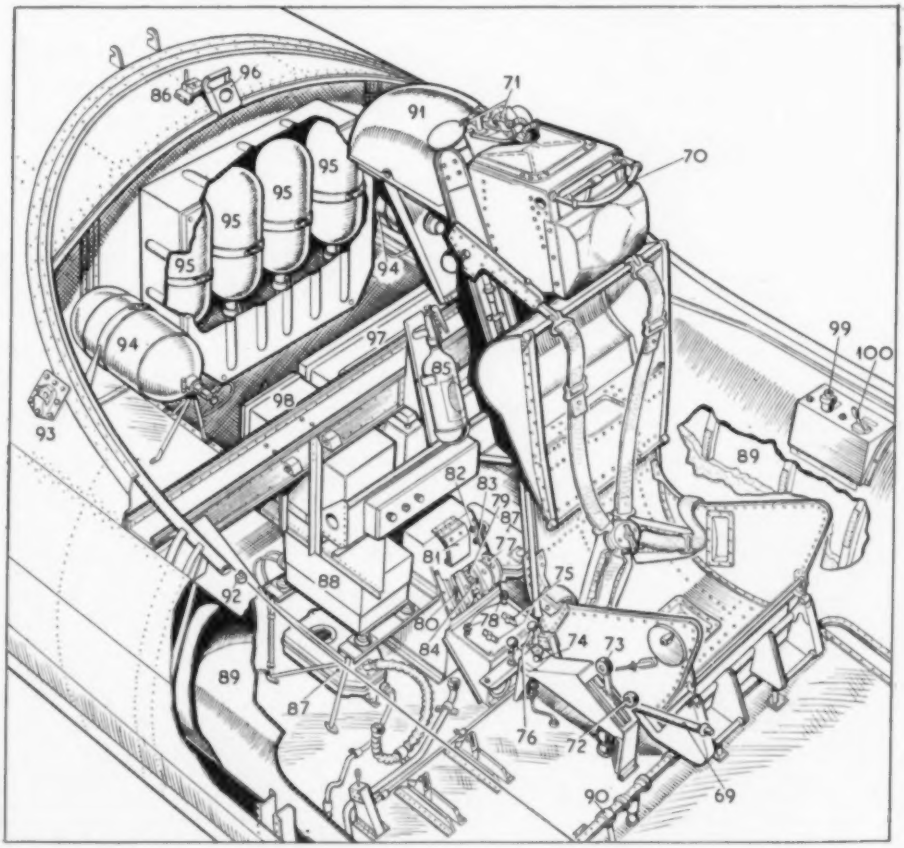
The dive brakes have been tested with satisfactory results up to the limiting dive speed of 490 kt. The official time for full opening of the brakes is 1.5 sec and the nose-up trim change with free controls, normal c.g. (21 to 22 per cent M.A.C.) gives less than 1.7 g, reducing at high Mach numbers.

We climbed back, and this time I was to dive a little more steeply and feel more severe buffeting. Once again I peeled over to port at about 34,000ft and down we went. The altimeter needle began to whirl round, the cloud tops seemed to be approaching very fast, and again came the shaking. I wondered if the probe would eventually shake off. At something a little over Mach 0.8 I again operated the dive brakes and, as before, a gentle recovery followed automatically.

The final dive was to be an all-out effort, and I had now got a better idea of dive angle. The nose went well down, and after Mach 0.8 at around 28,000ft, descending at more than 10,000 ft/min, we were really getting cake-walk treatment. At the point when the Mach needle was touching the red sector on the dial and showing 0.83 the right wing started to go down in spite of opposite aileron, and I felt that perhaps I had been shaken and compressed (as well as decompressed) enough. The indicated speed was 400-and-a-bit knots, which works out at 635 m.p.h. true or, in terms of Mach number, 0.831 indicated, which I was told was 0.85 after correction. Once again the dive brakes opened almost instantaneously, giving immediate recovery, and when the nose was pointing upwards again Sonderman told me to use the speed and pull round in a huge loop. With requests for guidance on how hard or otherwise to pull, I managed to complete the loop according to plan. On previous occasions, in other jet aircraft, I have usually either flicked out or stalled out on top. Jet loops seem so huge and slow to one who now usually flies light aircraft. The recommended speed is 300 kt.

During all this performance I had completely ignored the Nene, which whirred on regardless at 11,800 r.p.m. We had been airborne for about 30 minutes, and still had plenty of fuel.

Rolling in a machine of this sort is hardly to be regarded as an aerobatic manœuvre any more. At almost any speed, but preferably at 320 kt, and with more or less use of aileron and no conscious use of the other controls, the S.14 will roll smoothly

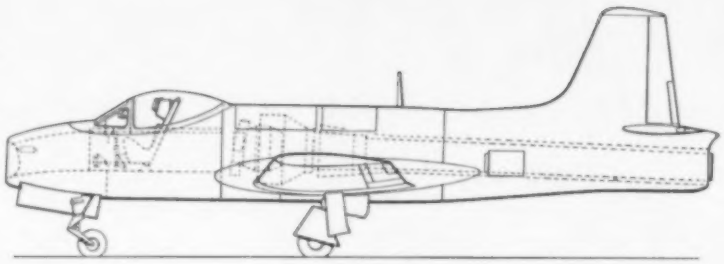


COCKPIT LAYOUT (II):

Equipment and controls continued :—

(69) Seat-position control, (70) Ejection-seat jettison control, (71) Safety pin and sear, (72) Cockpit-heating and ventilation control, (73) Windscreen-heating control, (74) Windscreen de-icing pump, (75) Rheostat for instrument-panel lighting, red and white, (76) Emergency oxygen controls for pilot and co-pilot, (77) Ground/flight switch, (78) Radio volume, pilot and co-pilot, (79) Ignition isolating switch, (80) Generator switch, (81) Gyro-compass corrector, (82) Wheel-door test, (83) Power-failure fuse, (84) Main fuse, (85) Hand fire-extinguisher, (86) Hood limit switch, (87) Oxygen economizer, (88) A.D.F. amplifier, (89) Engine air-intake ducts, (90) Cabin-heating pipe, (91) A.D.F. loop antenna, (92) Switch, hood fully open, (93) Hood lock, (94) Oxygen bottles, (95) Fire-extinguisher bottles, (96) Hood sliding rail attachment point, (97) Transmitter-receiver S.V.R.174, (98) Inverter S.V.R.174, (99) Anti-g suit selector valv (00) Anti-g valve.

FOKKER S.14 IN THE AIR . . .



The straight-through S.14 Nene has a revised contour for the lower line of the fuselage to accommodate the larger jet-pipe. Otherwise it is externally almost identical with the earlier design.

round its probe. The rate of roll is high without being exceptional, and at best is about 90 deg per second.

While we still had time and altitude I decided to spin the aircraft. This calls for no special procedure, and there are no limitations. I went in normally to the right (without aileron) from a slightly nose-up stall. After some reluctance to perform properly during the first half-turn, the S.14 condescended to do so and a quite smooth and slow spin of four turns lost only about 3,000ft. Recovery with the normal actions took less than one additional turn. Total height-loss back to level flight was perhaps 6,000ft. I learned that after a large number of turns the spin gets a little rougher, with some pitching; but recovery is still immediate.

For a jet aircraft of this type the speed range is remarkable; the stalling, which was next on my list of exercises, confirmed the low-speed end. The straight stall with flaps and wheels up and aircraft slightly nose-up came with little or no warning at just under 90 kt. A small shudder and the nose dropped as gently as if it had belonged to my Gemini. The similarity continued, for with wheels and flaps down the stall was just as docile; the aircraft remained almost level, the speed was no more than 75 kt, the rate of descent was low, and enough rudder control remained with stick fully back to hold the wings up if one dropped. Recovery in each case was immediate.

During the above-cloud flying Sonderman had been keeping a weather eye open quite literally, and obviously the stuff was moving in fast from the south. At one time there had been a small gap to the west through which ground and canals could be dimly discerned. We now dived down through layers and gaps, looking for this hole or one like it as a preliminary to creeping into Schiphol underneath. But everything had closed in and the lowest small lane was at 3,500ft. On the way down we had seen a good cross-section of the front of a front.

A check on the gauges showed that we had just comfortable fuel left to climb above again, find the beacon, and let down under control. Once again I had to plough up through the weather and this time the tops were considerably higher. The radio compass was most useful and efficient, and soon we were able to call Schiphol and report our approach to the beacon and request a let-down. The airport came back with standard airliner instructions to go north and hold. I believe Sonderman mentioned fuel shortage and requested permission to make a fast let-down on track from the beacon. The ceiling at the airport was about 600ft and visibility about one mile. The countryside is, of course, very flat. His request was granted, so we confirmed our position over the beacon, carefully set the altimeter, and then, following instructions, I put out the dive brakes and let down on a heading to bring us out over the west side of the airport. Speed was kept at 200 kt indicated with r.p.m. at 10,000, and the altitude to start with was about 16,000ft. The descent angle was quite steep and the rate averaged nearly 3,000 ft/min.

Some five minutes later we were down at 1,000ft, still in cloud, and we reduced our rate of descent and looked for breaks below. At 600ft there were blurred details, and at 500ft we were clear and obviously near the airport—though not over it. The air brakes came in. Sonderman knows every field and canal in this area of Holland, and we turned left onto the circuit, getting permission at once for a landing. Having slowed down to 140 kt I dropped the wheels and about half flap. The resulting trim-change is negligible. A slight increase in r.p.m. kept the speed at 135 kt round the turn in, and this I allowed to drop off to 125/130 kt for final approach.

The new approach lighting, put into operation on the main runway the previous week, certainly gave a great deal of help. The last half-mile and then the runway was laid out like a great arterial road ahead, white, red and green lights indicating line of approach, distances and threshold and touch-down aiming point.

Over the threshold green area, at about 95 kt, I cut the Nene back and concentrated on holding off. The visibility had been so poor when I had taxied out, and I had been so busy that I could not remember either the aircraft's height or attitude on the ground. The stick came back smoothly and the probe pointed up a little. I felt for the ground as it were, and when I was beginning to wonder about the float the S.14 greased on in one of the best landings I can remember doing. Apart from some luck it is only fair to say that the aircraft controls very nicely all the way down, and makes a very sweet and simple landing without the pilot doing more than give a little guidance.

With no more than a touch of brake we were slow enough to turn right at the second runway intersection and I taxied in and turned round to line up with a selection of Meteors, feeling about ten times as confident as when I had taxied out.

Much more could be written, and additional normal and emergency procedures could have been tried and discussed; the foregoing is concerned only with a single—and for me rather special—flight. I felt that I had had a full 60 minutes out of the hour, and I also confirmed my opinion that Capt. Gerben Sonderman is truly a royal pilot to fly with. The data which follow will help to complete the story.

DATA: FOKKER S.14 MACH TRAINER

Rolls-Royce Nene 3 (and Derwent 5)

Span	39ft 5in	Height	15ft 4in
Length	43ft 8in	Wing area	342 sq ft

PowerUnit	Nene 3	Derwent 5
Max. static thrust at S.L.	5,100 lb at 12,500 r.p.m.	3,470 lb at 14,550 r.p.m.
Max. cont. thrust at S.L.	4,090 lb at 11,800 r.p.m.	3,090 lb at 14,100 r.p.m.
S.L. cruising thrust	3,075 lb at 11,000 r.p.m.	2,670 lb at 13,600 r.p.m.
Min. spec. fuel consump. (S.L. static).	1.01 lb/hr/lb	1.022 lb/hr/lb

Aircraft	S.14 Nene	S.14 Nene with aux. wing tanks	S.14 Derwent
Weight empty	8,745 lb	8,895 lb	8,304 lb
Two pilots with parachutes ...	472 lb	472 lb	472 lb
Fuel	3,000 lb	3,600 lb	3,000 lb
Oil	13 lb	13 lb	24 lb
Take-off gross weight	12,230 lb	12,980 lb	11,800 lb
Wing loading (t.o. weight) ...	36 lb/sq ft	38 lb/sq ft	34.5 lb/sq ft
Corres. power loading	2.4 lb/lb	2.5 lb/lb	3.4 lb/lb
Aircraft Performance Data at gross t.o. weight			
Max. speed at 20,000ft	516 m.p.h.	515 m.p.h.	445 m.p.h.
Mean cruising speed at 30,000ft ...	386 m.p.h.	384 m.p.h.	366 m.p.h.
Min. speed at S.L., flaps 45 deg. ...	90 m.p.h.	92 m.p.h.	88 m.p.h.
Max. rate of climb at S.L.... ...	5,400ft/min	5,050ft/min	3,200ft/min
Climb at combat rating:—			
to 10,000ft	2.1 min	2.2 min	3.6 min
to 20,000ft	4.8 min	5.1 min	8.3 min
to 30,000ft	8.6 min	9.4 min	16.7 min
Add. time from release of brakes to best climb speed	1.1 min	1.2 min	1.3 min
Service ceiling (400ft/min climb)...	42,500ft	41,500ft	36,500ft
Take-off distance to 50ft	800 yd	900 yd	1,000 yd
Cruising time, 30,000ft, at mean cruising speed	1.35 hr	1.70 hr	1.45 hr
Ditto at 350 m.p.h.	1.50 hr	1.90 hr	1.55 hr
Ditto at 300 m.p.h.	1.70 hr	2.15 hr	1.85 hr
Time for climb to and descent from 30,000ft	0.25 hr	0.25 hr	0.4 hr
Max. range at 30,000ft (incl. climb) and average speed of 350 m.p.h.	565 miles	710 miles	620 miles
Max. number of take-offs and landings for training	16	19	19

"IN THE AIR" SERIES: THE FIRST FIFTY

(1) KZ-III, (2) Belfair, (3) Ercoupe, (4) KZ-VII, (5) Norecrin, (6) Super Cruiser, (7) Seabee, (8) Chipmunk, (9) Safir, (10) Newbury Eon, (11) Vampire, (12) M.B.5, (13) Fairey Primer, (14) Tudor, (15) Trent-Meteor, (16) Auster Avis, (17) Ace, (18) Scandia, (19) Fairey Junior, (20) Prentice, (21) P.108, (22) J.21R, (23) Desford, (24) Promotor, (25) Annular Tempest, (26) Mamba-Balliol, (27) Fokker S.11 Instructor, (28) Y.A.1, (29) Self-aligning Autocrat, (30) Ercoupe, (31) Aero 45, (32) Viscount 630, (33) Ambassador, (34) Beaver, (35) Hermes, (36) Autocar, (37) Firefly, (38) Prince, (39) Aiglet, (40) Skyjeep, (41) Sturgeon, (42) Fokker S.13, (43) Heron, (44) Ambrosini S.7, (45) Provost, (46) Ambulance/Freighter, (47) Aiglet Trainer, (48) Viscount 700, (49) Beaver 2 (Leonides), (50) Fokker S.14.

Among other types in the Editor's log-book are the following, arranged roughly in classes:—

Trainers, etc. (including trainer versions).—Tutor; Tiger Moth; B.2; Magister; Jungman; Stearman; Cornell; Proctor; Hart; Hind; Harvard; Lysander. **Small and Medium Twins.**—Anson 1 and 5; Oxford; Crane; Rapide; Lockheed 12; Dove; Gemini. **Bombers.**—Wellington; Mosquito; Stirling; Lancaster. **Fighters.**—Spitfire; P.38 Lightning; Meteor. **Civil Light Aircraft.**—Hornet Moth; Moth Minor; Aeronca; Messenger; Whitney Straight; Cub; Chilton; Auster I; Bonanza. **Helicopters.**—Bell 47; Sikorsky 51.

Flown under instruction (or as second pilot).—Walrus; London; Whitley; Blenheim; Dakota; Lodestar; Hastings; Nene Lancastrian; York; Stratocruiser; Bristol Freighter; Universal Freighter.

HELICOPTER DEVELOPMENT

THIS article is an abridged version of the paper "Rotary Wing Aircraft Development" presented by Mr. E. B. Schaefer (who is chief technical engineer, Canadair, Ltd., Montreal) before the Engineering Institute of Canada last month. The author's intention has been "to review the history and development of rotary wing aircraft, discuss the design trends and problems in general terms, and speculate a bit on future probabilities."

THE fixed-wing aircraft has made immense progress since the time of the Wrights, and with the advent of the gas turbine further advancement can be expected. This type of aircraft does, however, have several shortcomings that restrict its operation in varying degrees. These disadvantages include the requirements for large airports, the inability to rise and descend vertically and to hover, the inability to manœuvre in all three planes in a confined area, and the potential crash hazard due to possible loss of engine power.

If one delves into the history of man's effort to achieve flight, it becomes apparent that the earliest experiments were along the line of a direct-lift machine as opposed to the somewhat simpler problem of flying with forward speed. Leonardo da Vinci conducted quite extensive research on direct lift by means of the ornithopter principle and the aerial screw principle. One historical authority states that the first successful flight of a heavier-than-air powered machine was made in 1784 with a model helicopter devised by two French scientists, Launoy and Bienvenu. The first full-scale helicopter to fly and carry a pilot was that designed by Louis Breguet in 1907.

The Focke-Achgelis FW 61 which appeared in 1937, setting up new records for altitude, duration and speed, was generally accepted as the first fully controllable helicopter. By 1910, Igor Sikorsky had built two experimental machines, and in 1939 produced his famous VS 300 which set up a new endurance record of 1 hr 32 min. Also in 1939, the German engineer Anton Flettner developed the Flettner 282, the first helicopter to use two intermeshing rotors. The first jet-powered helicopter, with pressure jets at the tips of the rotor blades, was produced by the Austrian designer, Doblhoff, during the war. Another landmark was the Kellett XR-10 of 1947, which had 65ft-diameter intermeshing rotors and could carry ten passengers.

In present-day helicopters, many differing rotor configurations have been adopted. It seems probable that the field will narrow down to no more than two or three basic configurations. The performance of most helicopters is limited with regard to forward speed and range.

The helicopter has been used for a number of unique jobs, including the outstanding work on the Kitimat project in British Columbia. During this work a site survey, normally a three-year job by normal means, was accomplished in ten days; triangulation for a water tunnel (estimated to take a ground crew of 12 two seasons) was performed in six weeks, and impressive records for cargo carried were established by Bell 47Ds and Sikorsky S-55s.

The civil aviation side of the picture has been growing steadily, so that in addition to the several years of experience in carrying air mail in the Los Angeles, Chicago and New York areas, passenger shuttle services are now being operated. In Europe Sabena has inaugurated a scheduled passenger helicopter service, and in Britain B.E.A. has done much pioneering work.

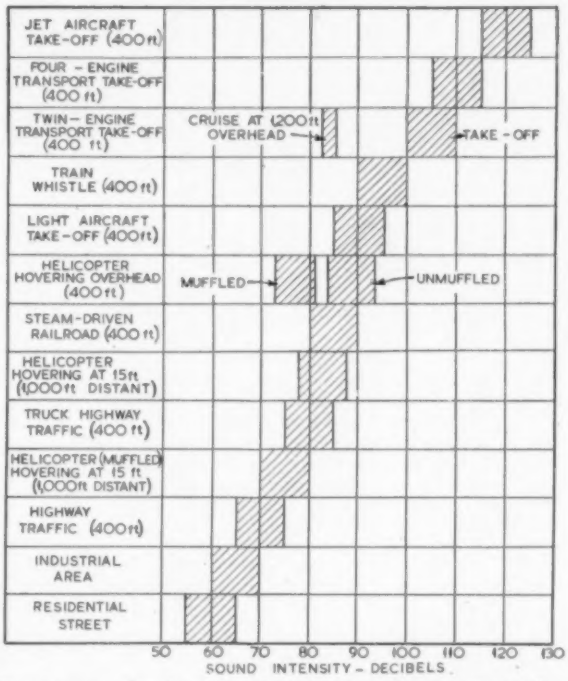
For airport to city-centre transport, and for short-haul inter-city services, the helicopter envisaged by the airlines would seem to require the following characteristics:

(1) Sufficiently low operating costs to give reasonable fare rates.
(2) Passenger capacity from 30 to 50.
(3) Range 200 to 300 miles, carrying fuel reserves and maximum payload.
(4) Ability to take-off and land in areas 300 to 400ft square.
(5) A speed of 150 to 160 m.p.h.
(6) For passenger transport the machine must be multi-engined and will require safe flight characteristics on one engine.
(7) The ability to operate in all weathers (this implies anti-icing protection and blind flying capabilities similar to those of fixed-wing aircraft).
(8) Efficient cabin ventilation and cooling.
(9) Excessive noise must be reduced.
(10) The external appearance of the helicopter should not "amuse, confuse or frighten the passengers."

Turning to the designs becoming available to the civil market, the twin-engined Bristol 173 is now flying, with accommodation for up to 13 passengers, and also the 173 Mk 3 with stub wings. Another British design, by Saunders-Roe, also includes a fixed wing in addition to the rotors, and goes one step further by adding a ducted fan installation for forward propulsion. This machine is planned to accommodate 40 to 50 passengers. Another design by the Fairey Aviation Company concerns a 40-passenger compound helicopter with a jet-driven five-blade rotor, and two turboprop engines under the fixed wings.

In the United States, the Piasecki YH-16 Transporter has made several flights. The American Air Transport Association Helicopter Committee has reported that an airline version of the YH-16 could carry 50 passengers and would have a gross weight of 45,000 lb, a cruising speed of 150 m.p.h., a payload of 10,500 lb and a range of 230 miles.

Another large machine now in the process of manufacture is the Sikorsky XHR-2S, again a military helicopter. It uses a single five-blade rotor and a tail rotor and the prototype will be powered with two 1,800 b.h.p. piston engines mounted on stub wings above the fuselage. The A.T.A. Helicopter Committee estimates that a civil version of this machine, having a gross weight of 34,000 lb, could carry 50 passengers at 160 m.p.h. over 200 miles. Payload is estimated at 10,000 lb.


JET AIRCRAFT TAKE-OFF (400 ft)
FOUR - ENGINE TRANSPORT TAKE-OFF (400 ft)
TWIN - ENGINE TRANSPORT TAKE-OFF (400 ft)
CRUISE AT (200 ft OVERHEAD
TAKE - OFF
TRAIN WHISTLE (400 ft)
LIGHT AIRCRAFT TAKE-OFF (400 ft)
HELICOPTER HOVERING OVERHEAD (400 ft)
MUFFLED
UNMUFFLED
STEAM-DRIVEN RAILROAD (400 ft)
HELICOPTER HOVERING AT 15ft (1,000 ft DISTANT)
TRUCK HIGHWAY TRAFFIC (400 ft)
HELICOPTER (MUFFLED) HOVERING AT 15 ft (1,000 ft DISTANT)
HIGHWAY TRAFFIC (400 ft)
INDUSTRIAL AREA
RESIDENTIAL STREET
50 60 70 80 90 100 110 120 130
SOUND INTENSITY - DECIBELS

This diagram, taken from Mr. Schaefer's paper, illustrates the relative external noise levels for various conditions.

From the experience now being gained in commercial helicopter operations, and the imminence of large military machines capable of commercial adaptation, it does not appear to be too rash to expect airline operation of helicopters in the 1960s. A recent A.T.A. long-range forecast of airline traffic growth in the United States estimates that, in 1960, 39.4 millions of passengers would be carried in fixed-wing aircraft, 6.1 millions by helicopters, rising to 45.5 millions and 22.2 millions in 1970. The proportion of total inter-city traffic carried by helicopters would increase from about 13 per cent in 1960 to 33 per cent in 1970.

The idea of a convertible aircraft or convertiplane designed to combine the advantages of helicopters and fixed-wing machines is approaching reality.

For the future, it may be expected that the military services will expand their respective fields of operation with rotary-wing aircraft, and will be the means of encouraging development of all the promising variants in design. The civil application will grow rapidly; short-haul commuter service is now beginning, and development will continue as more efficient and multi-engined machines become available.

The compound helicopter (having a fixed wing in addition to the rotors) constitutes the most likely configuration for the machine requiring higher cruising speeds and greater ranges. It seems likely that the further development of this type will be along the lines of turboprop engines for forward propulsion, with engine compressor air bleed for pressure-jet rotor-tip drive for the take-off, approach and landing portions of the flight.

[*An illustrated history of helicopter development was published as a series of three articles in "Flight" during January, 1951, and a summarized history appeared in the Helicopter Special Number, January 23rd, 1953—Ed.*]

The Walsall headquarters of the Helliwells organization, whose managing director is Mr. Eric Sanders, C.B.E.

MANUFACTURE and MAINTENANCE

The Aircraft Division of Helliwells, Ltd.: Its Work and Structure

SINCE the end of the war, and of lease-lend aid, that worthy and ubiquitous trainer the North American Harvard has been kept flying in this country largely through the work of Helliwells, Ltd. Holding the overhaul contract for these machines, the company has been responsible not only for their modification and overhaul, but also for the manufacture of replacement parts.

This has been but one aspect of the company's work. Other contracts include the maintenance of the M.T.C.A. Flying Unit fleet at Stansted, and sub-contracted manufacture and design projects. We were recently able to make a two-day tour of Helliwells' various units, using one of the firm's own aircraft, and to observe their various activities. From Croydon we flew to Cardiff to visit the company's factories at Treforest and Aberdare; then to Walsall (the company's main factory, headquarters and airfield) and Birmingham (where the research and development department of the Tube Investments group—of which Helliwells are members—is located) and then to Stansted. An account of the firm's background and our own impressions follow.

Helliwells, Ltd., have been actively engaged in the aircraft industry for the past 20 years. At the beginning, the company was concerned mainly with component manufacture, but activities have widened since 1937 to include the modification, repair and overhaul of many types of aircraft, in addition to sub-contracted manufacture of major components.

As mentioned, an important section of the firm's work has for many years concerned the overhaul of Harvards. The association began quite early in the war, when, by agreement with the North American company, Helliwells assembled all Harvards sent to this country under lease-lend. This was followed by the firm's assumption of full "sister firm" responsibility for the Harvard 2A, 2B and 3, which included the conversion of the aircraft to British standards to meet the R.A.F. requirements, and the regular overhaul of all R.A.F. Harvards in this country. In the post-war years, this work has played a large part in prolonging the useful life of the Harvard while more modern trainers have been under development.

To meet this and other wartime commitments (which included the repair, overhaul and modification of Bostons, Seafires, Spitfires and other types) a design department was formed. Today, this department, A.R.B. and A.I.D. approved, is engaged to a large extent on development work for Bristols and other major companies. Helliwells' total factory space covers an area of almost 300,000 sq ft, and includes a fully equipped machine shop and detail section as part of its production capacity.

It is at the South Wales factories that most of the company's manufacturing and sub-assembly work is carried out. This includes Harvard components and Pembroke sub-assemblies, which are subsequently transported to the Walsall factory; and also sub-contracted items, such as Canberra engine nacelles, cowlings and bomb doors, which are completed and delivered direct to the contracting firms. At present, much of this work is performed (together with Helliwells' non-aviation production in the field of metal tubing) at the Treforest factory, situated on a trading estate a few miles from Cardiff Airport: it is expected that increasing use will be made of the facilities of the well-equipped Aberdare factory also, in the near future. The technical director in charge of the South Wales factories is Mr. J. Ransom.

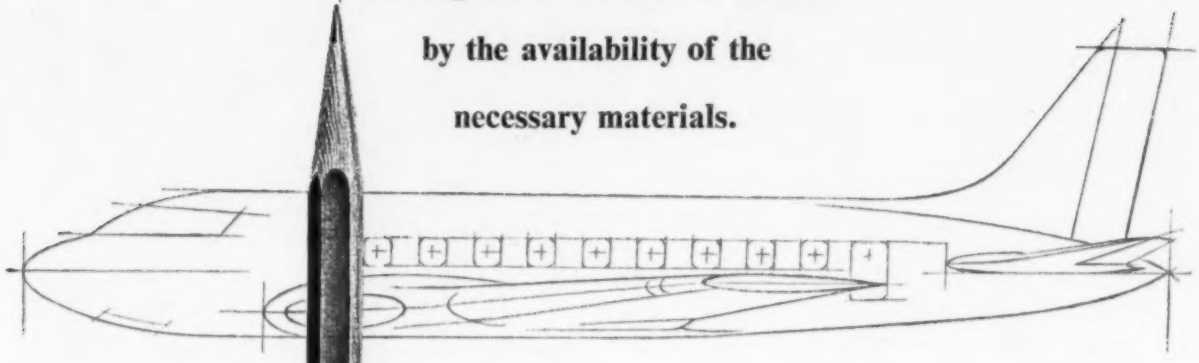
The inter-factory journey from Cardiff to the Midlands can be made speedily enough, we found, using the company's own executive transport, Dove G-AKJG, flown on this occasion by Helliwells' chief test pilot, Mr. J. A. Goodrum. The Dove is one of three aircraft available for business use by officials of the firm or of the T.I. group. The other two machines are a Rapide and a Globe Swift (the machine entered for the 1952 air races by G/C. G. F. K. Donaldson).

The Walsall factory, under Mr. G. Taylor Powell, general manager, is mainly engaged on the complete assembly of Pembroke wings, and the repair, overhaul and assembly of Harvard wings and other components. The last of the most recent batch of complete Harvard aircraft for overhaul—bearing the serial KF 448—was recently completed and is shown in the photograph (left). The Walsall facilities include those of a sheet metal-work section, engaged on prototype and small-quantity production work.

We visited next Mr. S. H. Pickrell, chief designer. His design and experimental department in Walsall is kept busy on a number of varied projects, including sub-contracted work such as the design of the air-conditioning installation for the engine nacelles and inner wings of the Britannia 300, and installations for the M.T.C.A. Flying Unit. Its record of past work includes the design of modifications, investigation of defects and preparation of technical publications for the Harvard; a large number of installations for the radio, electric, photographic and calibration equipment of seven types of aircraft used by the M.T.C.A. Flying Unit; complete re-stressing of the Globe Swift for proposed manu-

Final Walsall Harvard of the most recent overhaul batch: (left to right) Jack Goodrum, chief test pilot; Roger Mills, assistant test pilot; Mr. R. Clark, chief inspector; and Mr. M. E. Holroyd, A.I.D. inspector-in-charge.

No matter how brilliant the Aircraft Designer's conception, it cannot fly higher than the drawing board unless it is matched by the availability of the necessary materials.



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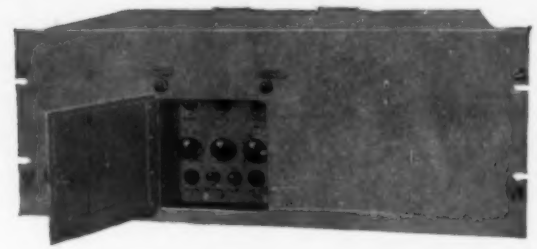

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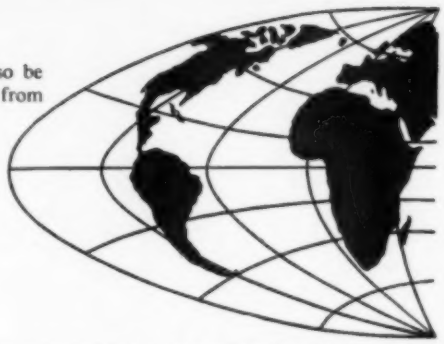

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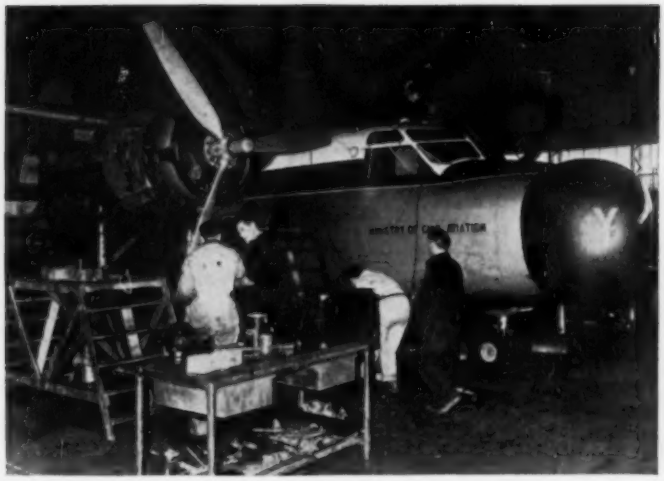


In these "Flight" photographs of the work of Helliwells, both manufacturing and maintenance aspects are seen. On the left is a view of Canberra engine cowlings under construction at the South Wales factory at Treforest, while (above) work progresses on a Percival Prince belonging to the M.T.C.A. Civil Flying Unit fleet, which is based at Stansted Airport.

MANUFACTURE and MAINTENANCE . . .

facture in this country; work on cockpit standardization and anti-flutter devices for the Ministry of Supply; and design of Provost engine cowlings and Prince long-range tanks.

In conjunction with the experimental department, who are responsible for the original design and manufacture of parts, the company's Stansted unit specializes in the installation of aircraft equipment to the special requirements of operators. Its main task is the maintenance, overhaul and modification of the aircraft fleet belonging to the Civil Flying Unit of the Ministry of Transport and Civil Aviation. Most of the staff have been engaged on this work since the inception of the Flying Unit in 1945, although it was not until April 1951 that Helliwells themselves took over the contract.

The M.T.C.A. fleet (seven Avro XIXs, five Consuls, three Doves, two Geminis and one Auster in 1951) now consists of one Avro XIX, five Consuls, five Doves, three Princes and one Chipmunk. It is the claim of Helliwells' Stansted unit that their experience in the operation and maintenance of Dove aircraft is second to none, and indeed most of their engineers (including Mr. E. A. Bott, the service manager in charge of the unit) have been working on this type of aircraft since 1947. The Ministry's Doves used for navigation-aid calibration (one of which was on show at Farnborough last year) are particularly good examples of the company's extensive installation jobs (a description was given in *Flight* of October 3rd, 1952), as are the calibration Princes.

In recent years, the Helliwell organization has been incorporated in the Tube Investments group of companies. One obvious advantage of this move is that the firm now has access to many resources, including raw materials, tube and extrusions to aircraft specifications: another is that the facilities of the T.I. department of research and development, in Birmingham, are now available to Helliwells. The department's staff of scientists and its extensive equipment (particularly on the metallurgical and electronic sides) together form a most useful potential, as our brief visit there showed.

This is the present background and structure of the aircraft division of Helliwells, Ltd. With the company's own past experience and the support of the T.I. group behind it, a further all-round expansion of its aircraft activity may be forecast with confidence for the future.

FORTHCOMING EVENTS

Jan. 15. Institute of Navigation: "Methods of Air and Surface Navigation," by W/C E. W. Anderson, D. H. Sadler, Lt. Cdr. R. B. Michell, R.N., and G/C. E. Fennessy.
Jan. 16. British Interplanetary Society (Midlands Branch): Brains Trust.
Jan. 16. British Interplanetary Society (Provisional Yorkshire Branch): Short-paper evening and Brains Trust.
Jan. 18. Photogrammetric Society: "New Stereoscopic Plotting Instrument for Aerial Photographs," by Professor E. H. Thompson.
Jan. 20. Royal United Service Institution: "Science in War," by Dr. O. H. Wansbrough-Jones, C.B., O.B.E.
Jan. 21. R.Ae.S. Main Lecture: First Mitchell Memorial Lecture, by J. Smith, C.B.E., F.R.Ae.S. (at Southampton).
Jan. 22. Helicopter Association: Brains Trust.
Jan. 23. British Interplanetary Society (Provisional Western Branch): "Astronautics in the Next 25 Years," by E. Burgess, F.R.A.S.
Jan. 23. Aircraft Recognition Society: All-England Recognition Contest. Royal Institution, London.
Jan. 26. R.Ae.S. Section Lecture: "X-ray Metallography," by Dr. G. L. J. Bailey.
Jan. 25-29. Institute of the Aeronautical Sciences: 22nd Annual Meeting, New York. (Honors Night Dinner, Jan. 25.)
Jan. 27. R.Ae.C.: Dinner to 1953 Air Racing Champion and winner of King's Cup.
Feb. 2. R.Ae.S. Graduates' and Students' Section: "Structural Analysis of Swept-back Wings," by D. Howe, D.C.Ae., G.I.Mech.E., Grad. R.Ae.S. (jointly with I Mech.E.Graduates).
Feb. 3. Royal United Service Institution: "Operational Applications for Water-based Aircraft," by G/C. G. W. Williamson, O.B.E., M.C., F.R.Ae.S.
Feb. 4. R.Ae.S. Section Lecture: "Air Intake Efficiency," by F. B. Greatrex, B.A., A.F.R.Ae.S.
Feb. 5. Photogrammetric Society: "New Plotting Machine for Air Photographs," by J. E. Odle.
Feb. 6. British Interplanetary Society: "Progress towards Astronautics," by K. W. Gatland.
Feb. 10. Radar Association: "Secondary Radar," by K. Harris.
Feb. 11. R.Ae.S. Main Lecture: "Recent Developments in the Structural Approach to Aeroelastic Problems," by Dr. D. Williams, M.I.Mech.E., F.R.Ae.S.
Feb. 13. British Interplanetary Society (Midlands Branch): "Astronautical Physics," by N. H. Langton, Ph.D.
Feb. 13. British Interplanetary Society (Provisional Yorkshire Branch): "Some Experimental Work on Rockets," by D. N. Hunter.
Feb. 18. R.Ae.S. Section Lecture: "Helicopter Research," by F. J. O'Hara, A.R.Ae.S. (jointly with the Helicopter Association).
Feb. 20. British Interplanetary Society (North-west Branch): "Building the Lunar Base," by R. A. Smith.
Feb. 24. R.Ae.C.: Dinner to speed and height record-holders.
Feb. 24. R.Ae.S. Graduates' and Students' Section: "Aircraft Plastics," by Lorne Welch.
Feb. 27. British Interplanetary Society (Provisional Western Branch): "Provisioning of Interplanetary Vehicles," by G. L. Garthwaite.
Mar. 2. R.Ae.S. Section Lecture: "Metal Sandwich Construction," by F. Tyson, B.A., A.F.R.Ae.S.
Mar. 4. R.Ae.S. Main Lecture: First Barnwall Memorial Lecture, by Major G. P. Bulman, C.B.E., B.Sc., F.R.Ae.S. (at Bristol).
Mar. 5. Helicopter Association: "The Design of the Drive," by J. L. Norton.
Mar. 6. British Interplanetary Society: "Design of a Life Compartment Necessary for Space Travel," by N. R. Nicoll.
Mar. 10. R.Ae.S.: 7th Louis Blériot Lecture (in Paris): "The Domain of the Helicopter," by R. Hafner, A.F.R.Ae.S.
Mar. 10. R.Ae.S. Graduates' and Students' Section: Annual General Meeting, and Film Show.
Mar. 13. British Interplanetary Society (Midlands Branch): "Establishment of the Lunar Base," by R. A. Smith.
Mar. 13. British Interplanetary Society (Provisional Yorkshire Branch): "Man in Space," by H. S. Peiser.
Mar. 20. British Interplanetary Society (North-West Branch): Short-paper evening by members of the branch.

R.Ae.S. Branch Fixtures (to Jan. 27).—Jan. 18, *Halton*, Branch Night. Jan. 19, *Belfast*, "Flight Testing Problems," by D. N. Scard. Jan. 20, *Bristol*, "Design Problems of the Transport Helicopter," by R. Hafner; *Coventry*, "Recent Developments in Gliding," by A. H. Yates; *Leicester*, A.G.M. and Film Show; *Manchester*, Lecture; *Preston*, "Stability and Control of Delta Wing Aircraft," by W/C. R. J. Falk. Jan. 21, *Southampton*, Main Lecture (see above).

Jan. 25, *Halton*, Junior Members' Night. Jan. 27, *Weybridge*, "Space Flight," by J. Humphries.

THE INDUSTRY

Westland Presentation

RECENTLY, before a gathering of the entire technical staff of Westland Aircraft, Ltd., Mr. Arthur Davenport, who recently retired from the post of technical director, was presented with an inscribed silver salver and an illuminated booklet containing the signatures of his colleagues.

In view of his long association with Mr. Davenport and the company, Mr. John Digby (chief designer, aircraft) was invited by Mr. Hollis Williams (technical director) to make the presentation. Mr. Digby referred to the many different aircraft for which Mr. Davenport had been responsible since he joined the company in 1915.

These machines were represented at the presentation in a display of very fine models, and in his reply Mr. Davenport said that they recalled the uphill battle which was fought to establish the monoplane; it was pleasing to remember that the Wizard was the fastest aeroplane of its day. [The Wizard was a high-wing design of the middle twenties; the Mk I, with Rolls-Royce XI engine, had a top speed of about 190 m.p.h.]

Versatile Switch

ADDED to the range of Austinlite rotary electrical switches for engineering and laboratory applications is a new model, the "Tenamp." The outstanding feature of this switch, and one which should make it particularly useful for incorporation in testing equipment, is the variety of circuits to which it can be quickly adapted; illustrated in a leaflet accompanying each switch are 18 typical circuits, ranging from single-phase on-off to three-phase reversing.

The mechanism offers four-way slow make-and-break, and a spring-loaded roller ensures positive location in each position. Constant contact-pressure is ensured by means of a compression spring which carries no current and therefore remains cool. The turnbutton handle is reversible, making the switch suitable for mounting on panels ¼in. to ½in. thick. Ratings are as follows: A.C., 5 amp 440v and 10 amp 250v; D.C., 5 amp 250v, non-inductive load.

The "Tenamp" switch is obtainable, price 10s 6d (discounts for quantity), direct from Austinlite, Ltd. (a subsidiary of Chance Bros., Ltd.), Lighthouse Works, Smethwick, Birmingham.

Light on Dark Subjects

WITH the increasing complexity of aircraft structures, problems of internal installation, maintenance and inspection grow correspondingly more difficult. Though the aircraft engineer is proverbially nimble-fingered he has not yet developed periscopic eyesight; and it is to fill this gap that Engineering Developments (England) Ltd., of 1 Adams Place, Georges Road, London, N.7, have developed their probe illuminators.

The latest type, the EDM.410 (as supplied to the M.o.S. for R.A.F. use under stores reference No. 5A/3859) has four alternative probes. One is a "preset flexible" metal type 18in long, carrying a 3.5 V solid crystal bulb at the extremity; the other three are of Perspex, 12in, 24in and 30in long respectively, protected by varnished cotton sheathing. The diameter of the Perspex probes is half an inch.

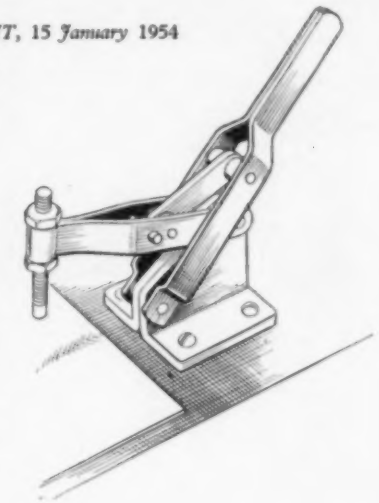
When the Perspex probes are in use, the light-source is incorporated at the handle end (the handle accommodates three U.2 batteries) and the light travels along the Perspex, which is a material of exceptionally high transparency. A probe of this type may therefore be inserted into an inflammable atmosphere, e.g., a fuel-tank interior; and, by reason of its insulating characteristics, it may also be used among live electrical circuits.

In each instance an adjustable-angle mirror of 1½in diameter is employed, clipped to the extremity of the probe to direct the light in any desired direction, or used for reflected vision; alternatively, the probe can be used as a light-source alone, without the mirror.

The complete set of equipment is accommodated in a finely finished, leathercloth-covered plywood case.

QUICK CLAMP

One of the range of Brauer work-holding toggle clamps, available in over 30 different models. The action is positive, and even the smallest sizes exert surprisingly powerful pressure. A variety of pads, including spring-loaded types, is available for the adjustable clamping foot. Dimensioned drawings of the complete range are available from the makers, F. Brauer, Ltd., Grove Road, Harpenden, Hertfordshire.



"Jet-proofing" Runways

JOINTS in runway concrete may open and close seasonally by as much as a quarter of an inch, and hitherto a satisfactory expansion joint has been secured by the employment of a compound of rubber and bitumen.

Increasing use of jet aircraft, however, has brought difficulties, the bitumen being softened by dripping fuel and/or heat and then blasted away from the joints.

Semtex, Ltd., a Dunlop company, have now developed and patented a new composition to meet this situation. Known as Semguard Grade J, and consisting of a special primer and blends of synthetic resin and rubber with other plastic materials, it is claimed to remain elastic both in summer and winter, to give positive adhesion to the concrete and to remain unaffected by jet fuel. It can be melted at about 150 to 160 deg C and poured into the joints without difficulty by the average contracting operative. The makers' offices are at Semtex House, The Broadway, London, N.W.9.

Aviation Fuel History

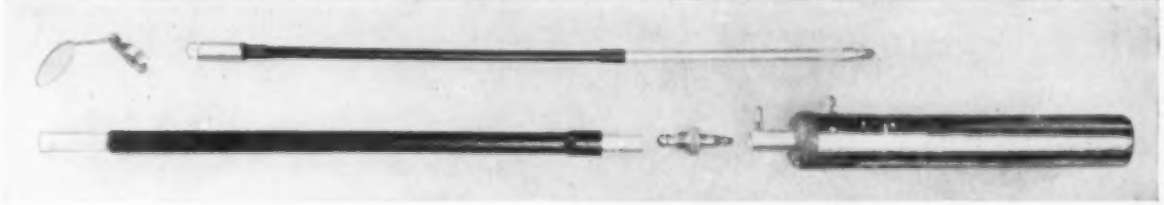
ENTITLED *The Power to Fly*, an instructive and entertaining colour-cartoon sound film has been sponsored by the Anglo-Iranian Oil Co., Ltd., to mark the jubilee of powered flight. Copies (16 and 35 mm) will eventually be available for loan, on application to the Trade Relations Department, Shell-Mex House, London, W.C.2.

Speaking at the first showing, Mr. C. M. Vignoles, O.B.E. (managing director, Shell-Mex and B.P., Ltd.) recalled that the company's association with aeronautics began soon after Blériot's Channel flight in 1909. A Mr. Ritchie, who was directing the construction of the Anglo-Persian pipeline in the Middle East, cabled home: "Please send an aeroplane like Blériot's, with instructions how to fly it." The order was duly fulfilled—but perhaps the instruction book failed in its purpose, for the monoplane was written-off on its first flight.

Soon after World War I the initials "B.P." became finally associated with aviation fuel. Many pioneer flights in the inter-war years were fuelled by Anglo-Iranian and the other parent company, Shell. It was during the second war, however, that the challenge to A.I.O.C. technical resources reached its peak. The war effort called for high-octane aviation spirit in quantities stepped up a hundredfold. In 1938-39 plans were made to build a high octane aviation-gasoline plant at Abadan, and by 1941 it was in production. It incorporated a new and important process—alkylation—developed by the company's technicians at Sunbury. From this plant, producing towards the end of the war at a rate of a million tons a year, A.I.O.C. contributed very materially to the success of the Allied air effort.

Now, in the jet age (as Mr. Vignoles said in his address) Anglo-Iranian is still to the fore and the B.P. Aviation Service is being continuously expanded.

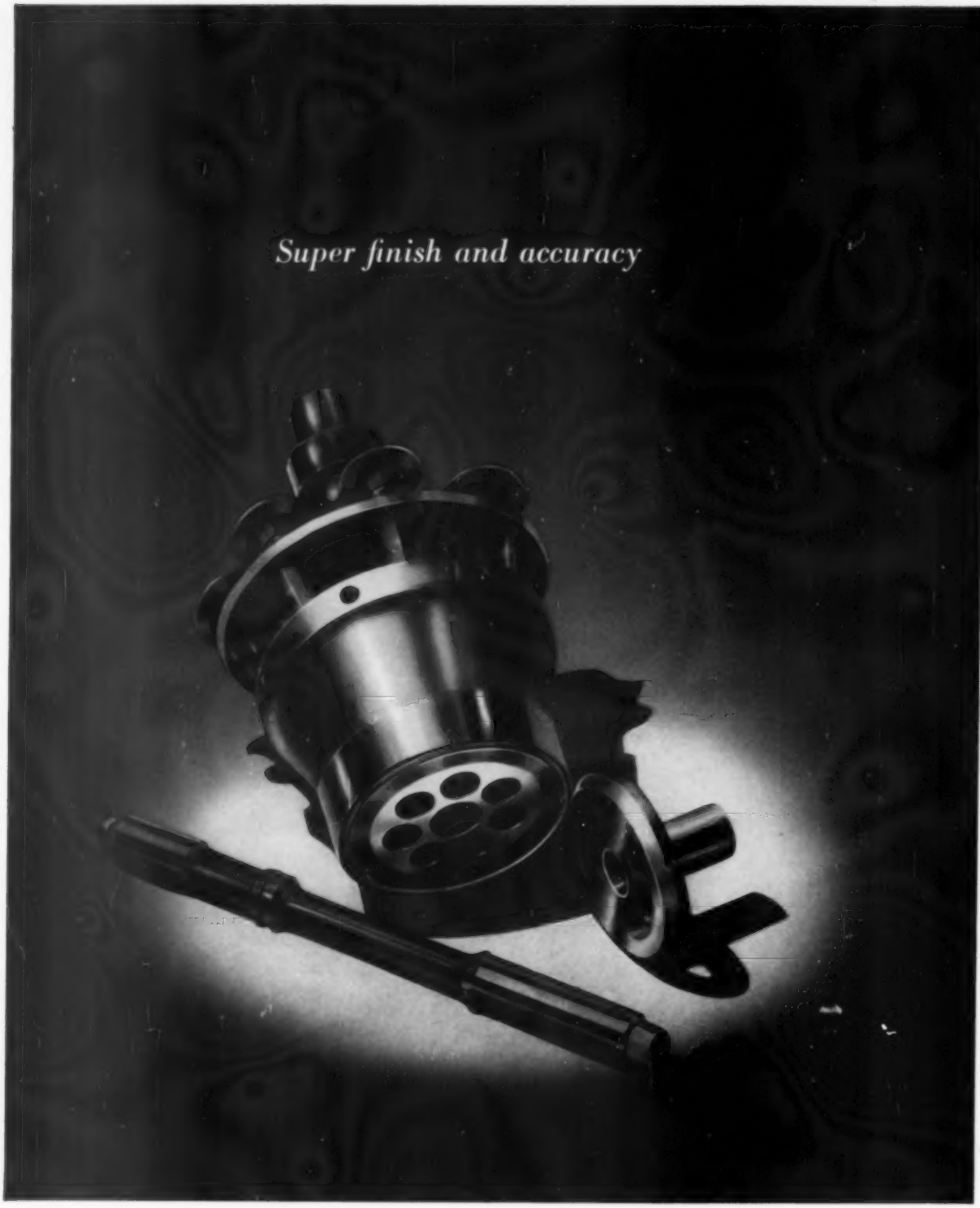
FOR LOOKING INTO IT: Two of the EDM inspection probes (see above), one flexible and one Perspex, with the battery-containing handle.



WESTLAND "WYVERN"

IN SERVICE WITH THE ROYAL NAVY

Super finish and accuracy



No. 3. Petrol at 2,000 p.s.i. flows from these fuel-pump components—of selected materials and finishes down to 2 micro-inches. Lubricated only by the fuel, these reciprocating and rotating parts operate at speeds up to 4,000 r.p.m.

FUEL AND COMBUSTION SYSTEMS FOR GAS TURBINE ENGINES

LUCAS

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., BIRMINGHAM & BURNLEY

CIVIL AVIATION

FOR BRIEFING PASSENGERS

PLANS are now well advanced for the introduction of public-address systems on British commercial aircraft. Such equipment, incorporated on most post-war American transports, has long been considered desirable and, with the introduction of larger aircraft carrying up to 100 passengers, is now becoming a necessity. With the aid of microphone and loudspeakers, the time and effort involved in briefing passengers before flight, and in passing on to them *en route* information, are greatly reduced; and the system has obvious advantages in an emergency.

B.E.A. and Murphy Radio, Ltd., have collaborated in the development of a new lightweight system—the MR 69A—initially intended for use on the Corporation's Viscounts and Elizabethans. The installed weight of this equipment, with five loudspeakers, is approximately 25 lb; the effect on payload is therefore very slight. It employs a noise-cancelling microphone which is believed to give much greater clarity than in previous systems. Satisfactory results were obtained last week during a one-hour test flight in a Viscount carrying B.E.A. executives.

American-built public-address equipment has always been fitted to B.O.A.C.'s Stratocruisers and it was added to their Constellations a year ago, but neither the Argonaut nor the Comet are so provided. Britannias will be fitted with the Redifon APA. 1 passenger-announcement system. It has not yet been decided whether Comet 3s will carry such equipment. Comet 2 crews will continue to use verbal and written methods of briefing passengers; it is not known whether this decision was made because of the jet airliner's lower cabin-noise level or because of the weight penalty involved in fitting the additional radio. Versions of the APA.1 have also been ordered by B.C.P.A. and T.A.A.

TWO'S COMPANY: The second Britannia prototype, G-ALRX, recently joined its predecessor G-ALBO (background) over Wales for this pleasing family portrait.

HD 32 TEST-FLOWN

ORDERS for no fewer than 70 aircraft of six different types have now been placed under the current re-equipment programme of Air France. Types already introduced are the Super Constellation, Comet 1A, Viscount and Provence. The latest orders are for 24 Hurel-Dubois HD 32s, adopted to replace the French airline's Dakotas, and for six Sikorsky S-55 helicopters.

The order for the thin-winged HD 32 was placed on the basis of performance achieved with the less powerful HD 31, which first flew in January 1953, and is powered by two 800-h.p. Wright C7BA1s. Two 1,200-h.p. Pratt and Whitney R-1830-29 Twin Wasps, as fitted to the DC-3, power the HD 32, which has just made its first flight at Villacoublay in the hands of Andre Moynet. The flight lasted 35 minutes and it is described as "completely satisfactory from the designer's point of view."

The high aspect-ratio (20.2) of this 42-seat airliner is claimed to confer an exceptional take-off performance; 2,130ft is quoted as the distance required to clear 50ft, and the landing run is 900ft.

NEW LONDON TERMINAL PLANNED

OUTLINE plans for building a new London terminal for airline passengers were announced last week. A newly formed private company named International Air Travel is stated to be negotiating with William Whiteley, Ltd., the London store, for the use of part of that firm's site at Queensway, Bayswater. It is proposed to erect there a four-storey building, presumably for the use of both British independent companies and foreign airlines.

Coaches now operated between London Airport and the two main passenger terminals at Waterloo and Victoria are scheduled to take up to 90 minutes for the journey, depending on traffic conditions. Use of the Bayswater terminal, it is thought, might cut out some of the densest traffic and reduce the time by at least 30 minutes.

Some 30 operators are reported to have shown interest in the scheme, although an element of overstatement in this report is suggested by the fact that this is greater than the number of scheduled airlines now serving London. Most of the foreign long-haul airlines use B.O.A.C.'s Airways Terminal at Victoria and the majority of European airlines use the newly opened B.E.A. terminal at Waterloo. Airlines whose passengers travel to and from Victoria include B.O.A.C., P.A.W.A., El Al, Qantas, T.W.A., Air India International, S.A.A., C.A.A., Panair, Skyways, T.A.E. and T.C.A. Airlines using Waterloo Air Terminal include B.E.A., Sabena, Air France, Swissair, Alitalia, Iberia, Iceland Airways, S.A.S., T.A.P., and Malta Airlines. K.L.M. (at Sloane Street) is the largest of those operators using separate terminals. Other terminals are those at Brompton Road (Airwork), Fitzhardinge Street (Hunting) and Brook Street (Aerolineas Argentinas).

EAGLE TRAFFIC SURVEY

FORMERLY director of the British Independent Air Transport Association, Mr. Philip Bremridge, A.F.C., has recently undertaken an assignment concerned with traffic research for Eagle Aviation, Ltd. Mr. Bremridge started flying as a private pilot in 1932 and served in the Fleet Air Arm before the war.

He served throughout the war in the R.A.F. as a flying instructor, and from 1943-1945 commanded the Flying Training Research Flight at the Empire Central Flying School. From 1945-1952 Mr. Bremridge acted as advisor on civil aviation and defence to the Conservative shadow-cabinet.

PENINSULAR VISCOUNTS

WHEN B.E.A.'s seventeenth Viscount (G-AMOL, R.M.A. *David Livingstone*) operated the first Viscount service in each direction between London and Madrid on Saturday, January 2nd, it not only replaced the Admiral-class Vikings on this route, with consequent time-saving, but it began the first stage of a complete reorganization and re-equipment of British air services to Spain, Gibraltar and Tangier. On that day, for the first time, a B.E.A. Leopard-class Pionair DC-3 (G-AMNV, *Sir Eric Geddes* on that occasion) operated a connecting service from Madrid to Gibraltar and Tangier.

B.E.A.'s route to Madrid had previously been operated *via* Bordeaux and their Gibraltar route *via* both Bordeaux and Madrid, with Admirals working all services. Now Viscounts fly five times a week between London and Madrid. Three of these flights are direct and two *via* Bordeaux. The Pionair is based at Gibraltar and connects with the Viscount services in each direction. It also provides through connection to and from Tangier as part of a new arrangement whereby B.E.A. operate two return Gibraltar-Tangier services every weekday on behalf of their subsidiary Gibraltar Airways. This company had since 1947 been flying the Gibraltar-Tangier route with Dragon Rapides.

Following the introduction of the Viscounts on the Madrid route B.E.A. have now replaced the Admirals on the London-Palma and London-Barcelona routes so that all of the Corporation's services between the United Kingdom and both Spain and Portugal are now flown by pressurized turboprop airliners.

The first Viscount service to Madrid was flown in 2 hr 30 min as against the scheduled block to block allowance of 3 hr 15 min. This time was bettered on the second day of operation (January 4th) by a flight of 2 hr 11 min, which (assuming a route distance of 810 miles) gave an average speed of 373 m.p.h. Other high-speed Viscount flights during the week were London-Lisbon in

CIVIL AVIATION . . .

3 hr 7 min and Rome-London in 3 hr 2 min. These flights point to the possibility of an anti-clockwise circular or elliptical jet-stream giving north to north-east tail winds of great strength to south-bound Spanish flights and south-east tail winds to flights from Italy. Winds of well over 100 m.p.h. were encountered at about 24,000 ft during this period.

WORLD'S BUSIEST AIR ROUTE

A CORRESPONDENT in Brazil reports that Cohingas Airport, Rio de Janeiro, registered no fewer than 6,435 landings and take-offs last October—a record figure. He adds that the route between Sao Paulo and Rio remains the busiest in the world. Figures for last year are not yet available, but in 1952 there were 2,241,000 passengers on flights between the two cities.

Another report from Brazil credits one of the nation's airlines with completing the longest non-stop commercial passenger flight—from Lisbon to Rio (4,803 miles). The aircraft was a Constellation of Panair do Brasil.

P.A.W.A. TRAFFIC RECORDS

SOME interesting figures were quoted by the traffic/sales vice-president of P.A.W.A., Mr. Wallis G. Lipscomb, in a report published on January 4th. By the end of last year the airline had completed 43,974 Atlantic crossings, 26,608 Pacific crossings (excluding the Pacific airlift) and 1,692 round-the-world flights. [Incidentally, the number of transatlantic flights completed to date is always displayed on the passenger steps leading into PanAm's transatlantic aircraft—a positive and highly effective way of reassuring timid travellers.]

The Pacific airlift, then in operation for three years and four months, accounted for a further 2,604 Pacific crossings, on which 114,271 passengers were carried. During the peak of transatlantic travel, P.A.W.A. carried 4,106 passengers in one week between Europe and America—more than the number taken by both the *Queen Elizabeth* and the *United States* over the same period.

The total number of passengers who flew with PanAm in 1953 was 1,650,000, compared with 1,430,000 in 1952—an increase of 15 per cent. The proportion of "tourists" rose from 38 per cent in 1952 to 53 per cent last year.

Such figures strengthen our belief that the term "tourist," still used by most of the world's airlines, has lost any value it had when the second fare-level was originally introduced by I.A.T.A. companies in 1952. Cheaper fares, and a correspondingly lower standard of luxury, were then the exception rather than the rule. Two classes of travel are now offered on most domestic and international routes, and the so-called "tourist" network will be extended to all regions by the end of this year.

Experience to date suggests that there will always be a minority willing to pay a surcharge on more luxurious travel, but that the majority of passengers will choose the cheaper service—as on road, rail or sea. (At the same time, we venture to predict that public feeling will turn against the present tendency to put ten passengers into a space which can accommodate only seven or eight in reasonable comfort.) In the circumstances, "tourist" appears to be a needless euphemism; in our view it would be more logical to speak simply of "standard" and "first-class" services.

GERMAN PILOTS AT A.S.T.

A SIGN of Germany's forthcoming re-entry to commercial aviation was the arrival at London Airport on January 4th of the four German pilots chosen for practical and theoretical instruction with Air Service Training, Ltd., at Hamble. Not until the Bonn Convention is ratified will the new Lufthansa begin operation; nor is it yet permissible for German nationals to fly powered aircraft. Special concessions therefore had to be made to allow the first four pilots to begin refresher training. As reported in *Flight* last week the pilots are accompanied by three ground instructors specializing in meteorology, engineering and traffic-control.

Luftag, the company formed to prepare for the re-birth of Lufthansa, is setting up a school at Dusseldorf where most of the new airline's staff will be trained. The instructors' visit to Hamble is intended to provide experience of up-to-date training methods rather than technical knowledge. The met. instructor, Dr. H. Regula, has in fact been a practising forecaster since the 1930s, and since 1948 he has been employed at Rhein-Main Airport. Herr F. Zehnder, the traffic controller, was trained by the Allied High Commission and has worked at several German airports.

With an average age of 45, the four pilots all have command experience on the pre-war routes of Deutsche Lufthansa. One, Herr J. Rathje, has not flown since 1940, although his log book shows 15,000 hr; the others, who were flying with the Luftwaffe up to 1945 on transport and instructional duties, are W. Blume, H. Topp and R. Mayr. Herr Blume has 78 crossings of the South Atlantic to his credit, and Herr Topp flew Ju 52s from Berlin to Croydon for 18 months. Their arrival at A.S.T. was preceded by some two months' ground training in Germany.

LUFTHANSA IN TRAINING: Pictured on arrival at London Airport by B.E.A. Viking are the four German pilots and three instructors referred to in the paragraph below. In the back row are the instructors (left to right): H. Regula, F. Horbach and F. Zehnder; the pilots (left to right) are R. Mayr, W. Blume, J. Rathje and H. Topp—all pre-war captains.

The three-month course at Hamble is designed to give the pilots a basic commercial qualification and to acquaint them with the numerous techniques and equipment introduced to commercial flying since 1939. Refresher flying on Chipmunks will be followed by intermediate training on Consuls, on which they will fly most of the hours required for their commercial pilot's licence with instrument rating and R/T. licence. The German pilots will also do sufficient flying on Dakotas to add a type rating to their commercial licences. Shortly after completion of their training with A.S.T. they are expected to visit America, each returning to Germany as co-pilot on one of the four Convair 340s ordered for Lufthansa.

SILVER CITY LAST YEAR

MAINLY due to the company's enterprising cheap-fare policy, remarkable increases in traffic were recorded by Silver City Airways in 1953. The total number of capacity ton-miles flown by the airline's Bristol 170s and Dakotas on both scheduled and charter services rose from 4.5m in 1952 to 7.6m last year, and the total load ton-miles flown increased from 2.4m to nearly 4.3m.

Most of the extra traffic was on the cross-Channel ferry routes, which in August alone accounted for as much traffic as in the whole of 1952. In that month there were as many as 170 crossings per day—a frequency which is almost unparalleled in world airline operations. The Freighters and Superfreighters averaged 3,200 landings and take-offs each in 1953; this is believed to be a record figure for large commercial aircraft. Still more intensive operation will result from the opening, later this year, of Silver City's new airport at Ferryfield. At first, Ferryfield's night-flying facilities will be used only to take up any backlog of traffic which builds up due to daytime delays. Eventually, however, round-the-clock ferry services are envisaged. Silver City expect their ferry traffic to increase by about 50 per cent in 1954.

There were over 14,700 flights across the Channel by S.C.A.'s aircraft last year. Charter services—carrying loads ranging from "marble angels to guided missiles"—brought the total number of hours flown to 11,650, and the mileage flown to 1.58m; 1953 was the first year in which the figure of one million miles has been exceeded by the company's aircraft. Operating statistics for both scheduled and charter services are summarized below.

	Car Ferry		Charter	
	1952	1953	1952	1953
C.T.M.s	1,565,147	4,229,733	2,971,257	3,367,237
Rev. ton-miles	790,942	2,630,698	1,632,550	1,637,588
Aircraft miles	298,585	837,570	663,777	741,254
Loads carried (units):—				
Passengers	27,270	95,287	1,566	1,338
Cars	6,865	24,011	31	52
Motor cycles, etc.	2,203	8,222	—	5
Pedal cycles	1,842	6,740	—	11
Loads carried (short tons):—				
Freight	12,151	38,872	8,429	9,022
Passenger	2,481	8,664	262	124
Total	14,632	47,536	8,691	9,146
No. of flights	5,353	14,714	3,381	3,985
Av. rev. load (lb.)	5,465	6,460	—	—
Av. stage distance (s.m.) ...	55.8	57	—	—
Hours flown	2,219	6,202	4,680	5,246

CIVIL AVIATION . . .

BREVITIES

FOR the past six years commercial manager and deputy general manager of West African Airways Corporation, Mr. D. Malcolm Brown has returned to B.O.A.C.'s Airways Terminal offices as deputy to Mr. M. D. Morrissey, U.K. and European sales manager.

* * *

The president of S.A.S. states that his airline carried more Japanese passengers to Europe than all other airlines combined, and carried 10 per cent of the past summer's North Atlantic traffic. He adds that S.A.S. and Swissair will pool their South American services during the coming year.

* * *

Mr. Wilfrid C. Gawthorne, civil air adviser to the Commissioner General, S.E. Asia, and civil air attaché in Siam, the Philippines and Vietnam, has been additionally appointed civil air attaché to H.M. Embassies at Djakarta (Indonesia) and Tokyo. He will remain based at Singapore.

* * *

Transport movements at U.K. aerodromes in November totalled 11,800, approximately two per cent more than in November 1952, and the number of passengers handled (187,000) showed an increase of 11 per cent. Passenger traffic at London Airport increased by 42 per cent to a total of 78,000, but the number of passengers handled at Northolt dropped by 46 per cent to 23,900.

* * *

Under certain conditions, captains flying under supervision may now submit such experience as part of the pilot-in-charge time required for Senior Commercial or A.L.T.P. licences. Details are given in *Civil Aviation Information Circular* No. 128/1953.

* * *

Amended airworthiness requirements for Rotorcraft (Section G of B.C.A.R.s) were issued by the A.R.B. on January 1st, replacing the provisional issue dated December 1949. The Council of the A.R.B. also announce the issue of the following *Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft*: No. 44, Issue 1; No. 10, Issue 7; No. 7, Issue 16; No. 6, Issue 14; No. 4, Issue 14; the Contents List, Issue 16.

* * *

A recent study by the Chase National Bank of New York makes some interesting comparisons between airline operations in the United States and in Latin America (where traffic has increased tenfold since 1939 and has doubled since 1946). In an area 2½ times as large as the United States the Latin American carriers' 700 aircraft serve three times as many towns, cover 2.3 times the route mileage and log an annual total of 3,250m passenger miles —or one-third of the traffic of U.S. carriers. Operational costs in Latin America, the survey concludes, are greatly increased by duplication of services on many routes.

CLUB AND GLIDING NEWS

DECEMBER, according to David Ogilvy, C.F.I. of the Elstree Flying Club, turned out to be "the worst of all time" with the weather restricting flying to a total of only 73 hours. This nevertheless brought the year's total to 2,368 hours, well above the 2,000-hour target. Commencing on January 21st, regular periods of night flying are being instituted at Elstree on Thursdays, beginning at dusk. Full instruction will be available for the night-flying rating, and elementary familiarization exercises will also be held. Non-Elstree pilots interested in taking advantage of the club's night-flying facilities should contact Mr. Ogilvy. Tomorrow, January 16th, the club's party in belated celebration of the New Year is to be held.

THREE weeks ago we gave figures for 100 km and 500 km closed-circuit records established (subject to F.A.I. confirmation) by an Ambrosini Super VII flown from Ciampino, Rome, by Ing. G. A. Ferrari on December 5th. Further attempts have since been made with another Ambrosini type. Ferrari's records were in Class C.1.c (1,000-1,750 kg a.u.w.). The subsequent flights—on December 27th—were in Class C.1.a (under 500 kg), by an F4 Rondone flown near Milan by Iginio Guagnellini. Speeds for the 100 and 500 km courses respectively were 254.75 km/hr (158 m.p.h.) and 249 km/hr (154.8 m.p.h.). The figures are subject to F.A.I. confirmation. It may be recalled that the F4 Rondone is a low-wing, two-seater aircraft having a tricycle undercarriage, and powered by one Continental C90 engine. It is at present being replaced in production by the F7 three-seat version.

OTHER news from Ambrosini concerns the firm's CVV 6 Canguro two-seat sailplane, which has a span of 63 ft, aspect ratio of 17 and an equipped weight of 617 lb. Construction is of wood, with a monocoque fuselage and a single-spar cantilever wing built in two sections. The leading edge of the wing has plywood skinning to form a torsion box with the spar, while the rear section is fabric-covered. One-third-span ailerons are fitted; rudder and elevators are fabric-covered. The seats are arranged in tandem in the enclosed cockpit, with duplicated controls and full I.F.R. instrumentation. The canopy is jettisonable.

THE formation of Yeadon Aero Club and the re-opening of Yeadon Airfield, near Leeds, for club and charter flying were celebrated on Sunday last, January 10th, with a cocktail party in the smartly redecorated club-house. The idea for the club was originally mooted by Mr. Lawrence Dawson a year ago, when it was first known that Lancashire Aircraft Corporation was to withdraw from the airfield. The formation of Yeadon Aviation, Ltd., followed, whose objects were to lease the airfield from the Air Ministry and to operate a flying club there.

The flying side of the club's operations is being handled by the Heaton brothers, proprietors of the East Riding Flying Club (Speeton), Ltd., of Speeton Aerodrome, near Bridlington. Their fleet, consisting of seven Tiger Moths, four Austers, three Geminis, and three Proctors, will now be sub-divided and based according to demand at Yeadon and Speeton. The managing director, Mr. Desmond Heaton, operates a Comper Swift (G-ABUU) for his personal use.

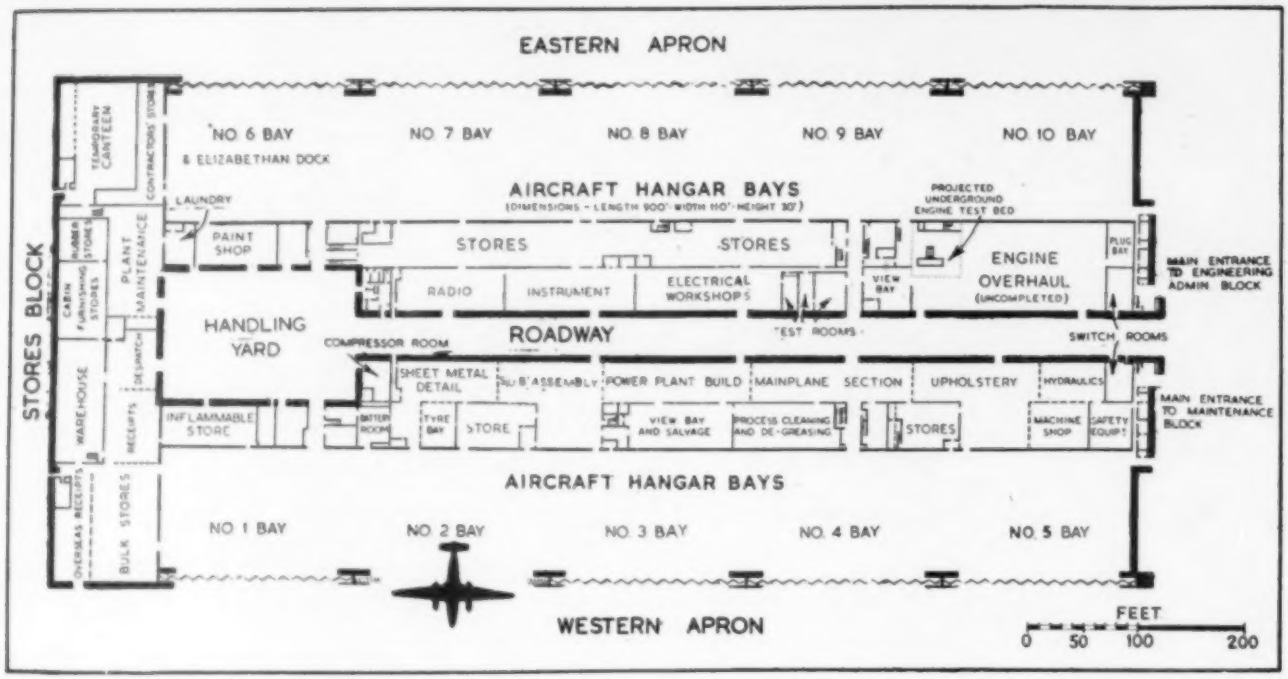
Under Mr. G. Heaton at Yeadon, the club's instructional staff will consist of Mr. A. R. Carvell and Mr. R. K. Roberts. In general charge of the operational section of the club is Mr. P. J. Selby, who has experience both as airline pilot and as ground engineer. Initial membership is expected to be about 250, and full maintenance and hangarage facilities for private owners are available. The training of Air Training Corps cadets also is expected to form part of the club's activity—an extension of the Heaton brothers' Speeton work.

Our own impressions, gained from a visit last Sunday, are that the new club is well qualified to carry out a good job of encouraging the air-fairing outlook in Yorkshire's West Riding. Its progress will be followed with interest.

R.Ae.C. PILOTS' CERTIFICATES AWARDED—DECEMBER, 1953

No.	Name	Class	Date
28,556	P. R. Keating	3	2.12.53
28,557	R. T. H. Patterson	3	9.12.53
28,558	P. N. H. Gush	1	9.12.53
28,559	R. I. Campbell	3	11.12.53
28,560	L. G. Cooper	3	15.12.53
28,561	K. W. Bradley	2	29.12.53
28,562	G. F. Goddard	4	30.12.53
28,563	C. Mastin	1	31.12.53

"WESTPORT RED" colour scheme and a price reduction of some £55 (to just under £3,000) are the main new features of the attractive Cessna 170, 1954 model. All-metal construction is used for the 4-seat machine which is powered by a 145-h.p. Continental flat-six engine.



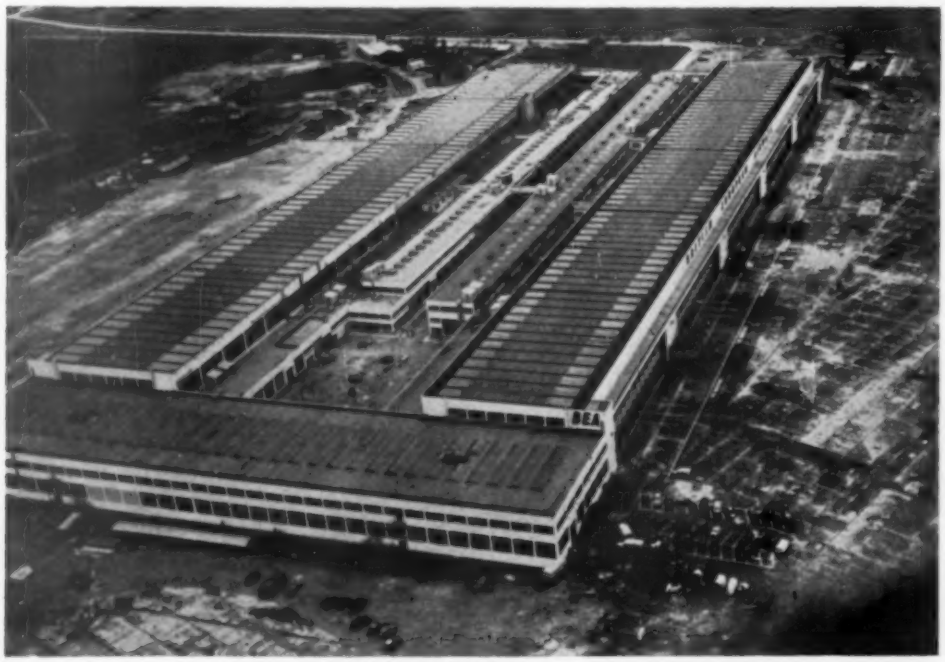
B.E.A.'s ENGINEERING BASE

AIRLINE executives from many nations have inspected and admired B.E.A.'s £2½m engineering base at London Airport, now a familiar landmark. Work on the site began in September 1950, and the first of the ten hangar bays was opened in April 1952. Finishing touches are now being added to the tenth bay and the canteen, and next month should see the end of the builders' labours. About 1,100 B.E.A. staff have been transferred to L.A.P. from Northolt over the past two years.

In addition to the engineering staff employed there on minor and major maintenance of Vikings, Viscounts and Elizabethans, the base houses the project and development, purchasing and administration departments—all of whom will obviously benefit from their close proximity to engineering work on the Corporation's new aircraft. The B.E.A. instrument and electrical sections have not yet taken up their new quarters, and although engine overhaul facilities are incorporated there is no immediate plan to make use of them. In most other respects the transfer process is nearing completion.

As the illustrations show, the engineering base has two large hangar buildings, each split into five bays, and each backed by a workshop building. Office accommodation is mainly at first-floor level. Pre-stressed concrete has been used extensively in the construction of both hangars and workshops; the hangar roofs are of pressed aluminium sheeting. Electric overhead cranes travel the entire 900ft length of hangars and workshops.

Working conditions at the base are impressive. High-intensity fluorescent tubes give clear light without shadows, and heating is by a high-pressure hot water system. Warm water pipes buried in the hangar floors ensure a quick return to a comfortable temperature at working levels even after the huge hangar doors have been opened in cold weather.



The ground-floor layout of the base is shown in the plan view at the head of the page. An idea of its size is given by the silhouette of an Elizabethan (span, 115ft). Dimensions of the two sets of hangar bays are: length, 900ft; width, 110ft; height, 30ft.; each of the ten bays has electrically operated Esavian folding doors spanning 150ft.

Superficially, the base appeared almost complete when this photograph was taken from a B.E.A. helicopter late last year. Claimed by the Corporation to be "possibly the best maintenance base existing anywhere", the building is situated in No. 1 Maintenance Area on the south-east side of London Airport.

CIVIL AVIATION . . .

AUSTRALIA'S PRIVATE AIRCRAFT

Not Enough of Them, says Mr. R. G. Casey

FOR many years, Mr. R. G. Casey, Australian Minister for External Affairs, has been an active private pilot and owner, while Mrs. Casey is well-known in Australia as head of the Australian Women Pilots' Guild and an enthusiastic pilot. Until recently, their own machine was a Fairchild Argus, but they have now been supplied with a Miles Messenger by the firm of W. S. Shackleton, Ltd., of London.

In an article dated January 1st, and written after a visit to the U.S.A. and Canada, Mr. Casey has called attention to the scope for an increase in the number of light aircraft used in his country. Although intended primarily for the Australian public, the article is certainly of interest to *Flight* readers in this country also, and we give below the main points from it. As we note briefly at the end, the position in Britain is even more disappointing.

As regards licensed private pilots [Mr. Casey states] there are 180,000 in America, 4,100 in Canada and 1,500 in Australia. Allowing for the differences in population, for every private pilot in Australia, there are nearly two in Canada and over six in America. As to the number of aircraft privately owned by individuals, there are 55,000 in America, 1,050 in Canada, and 325 in Australia. In other words, allowing for the differences in population, there are nearly twice as many in Canada and nearly ten times as many in America. So, in any real meaning of the term, Australia is far and away the least airminded of these three countries.

The figures show that the most airminded country in the world is the United States. They have 82,000 civil aircraft registered, of which, as I have said, 55,000 are private individually owned non-commercial aircraft. Twenty per cent of the total hours flown by all aircraft in America is done by these privately owned non-commercial aircraft.

There is in the United States another category of aircraft—those owned by a wide range of business companies, apart from commercial airlines and other commercially used aircraft (such as crop dusting, air photography, etc.). There are nearly 10,000 aircraft used by business companies for saving the time of their executives and representatives, and for first-hand, on-the-spot supervision.

This "business flying" accounted for 3,124,000 flying hours in America in 1952—or 38.2 per cent of all flying in the United States. They did 2,000,000 hours in the first six months of 1953. The accident rate was one fatality per 200 million miles flown. This fleet of 10,000 aircraft, owned by 8,000 companies, is worth $200,000,000 and costs $75,000,000 a year to operate. Presumably they don't do this for fun, but because it's a time and money saver and a business stimulator.

In addition, privately owned aircraft did 1,630,000 hours—and crop dusting and spraying accounted for 707,000 hours—and industrial flying (air photography, etc.) 317,000 hours—as well as instructional flying 1,500,000 hours.

Mr. Casey concludes: "Compared with the above, flying by other than commercial airlines is on such a small scale in Australia as not to be worth mentioning. There must be some very clear reason why the Americans find flying such good value—and we don't. Again, I venture to ask—why?"

Flight can add a pertinent footnote to the Minister's views by quoting M.T.C.A. and A.R.B. figures for corresponding activity in this country: private pilots' licences 6,043; student pilots' licences 2,410; privately owned aircraft, approximately 260 with current Cs. of A. Therefore, allowing for population differences, for every two private pilots in the U.K., there are three in Australia, five in Canada and 20 in the U.S.A. The proportionate number of private aircraft is even more striking: for every one in the U.K., there are nearly eight in Australia, 15 in Canada and over 70 in the U.S.A. A significant ratio is the number of private pilots per private aircraft; in this country there are some 20 pilots per aircraft, in Australia five; in Canada four; and in the United States three.

GLENN MARTIN ON AVIATION THEN AND NOW

THE U.S. Chamber of Commerce auditorium in Washington was the venue for the seventeenth Wright Brothers Lecture, delivered by Mr. Glenn L. Martin before the Institute of the Aeronautical Sciences on December 17th.

Of the Wrights, Mr. Martin said: "It was their indomitable faith in truth that guided them through all their investigations, and that ultimately—perhaps inevitably—brought them to success at Kitty Hawk fifty years ago." The quality of honesty in daily dealings, he said, was an infallible guide to a man's capabilities in the engineering and scientific fields. Structures and machines were unforgiving of the cheater and inevitably indicted those who toyed with the facts. Honest men had built the great aircraft industry and would guide it to sound growth in the future.

"In a free, independent society," Mr. Martin went on, "there can be no grand guiding hand controlling the destiny of an industry or a people. We in the aircraft industry have guided our own progress through our faith and loyalty to one another. The modern aeroplane constitutes an integration of the thoughts and lifetime work of more individuals than any other industry on earth. This integration was accomplished not by fiat but by understanding co-operation between its many and diverse elements."

Turning to criticisms that modern aircraft were too costly, Mr. Martin pointed out that the condition was not new; even in the later days of the First World War there were such cries, and they continued intermittently over the years. The aircraft was a vehicle, he pointed out, whose cost increased directly with its usefulness; and today's military aircraft were not greatly out of line "costwise" with their predecessors of thirty years ago if usefulness and capability were considered.

In the course of his reminiscences Mr. Martin paid tribute to Dr. F. W. Lanchester. He said, "Prandtl's work did not become available in America until after World War I and our authority in the early days was Frederick W. Lanchester, one of the great geniuses of aviation. His classic textbook *Aeronautics* appeared in 1907 and presented his concept of 'circulation' and the existence of vortices at the tip of wings. I must admit that all of us found Lanchester very hard going, since he used very little mathematics in his work and relied largely on page after page of laborious discussion.

"Succeeding papers by Prandtl and Lanchester between 1907 and 1919 developed the theory of the finite wing, the thing we were all interested in, and explained scientifically what we all had known from experience—that the best lift-drag characteristics are obtained from a high-aspect-ratio wing. The Lanchester-Prandtl theory, as some call it, provided the first rational basis for the aerodynamic design of wings and also gave loading information needed for structural design. It also clarified the aerodynamics of biplanes and explained the existence of interference between the two wings, which we had begun to suspect and which led, eventually, to the monoplane. One of the important results of this theory was the fact that it broke wing design down into two separate parts; the effect of airfoil section and the separate effect of wing geometry."

Mr. Martin remarked that on the fiftieth anniversary of powered flight in America a speed of 1,327 m.p.h. and an altitude of 83,235ft had been achieved in man-carrying aircraft. "We have lifted a payload of 100,000 lb," he went on, "and we have carried a load of 10,000 lb for a distance of more than 10,000 miles. We have flown around the world non-stop, we have carried 308 people in an airplane, and we have flown a distance of 11,236 miles non-stop without refuelling. Only a few days ago we witnessed the inauguration of a scheduled non-stop trans-continental air service in less than eight hours. Today we have a combat airplane in quantity production that flies regularly and smoothly at supersonic speed in level flight. The list of such miracles is endless."

The lecturer concluded by making the prediction which we quoted in a recent issue: "I have no hesitancy in predicting for the second half-century of flight in America interstellar space ships with speeds of 25,000 m.p.h.; giant 200-passenger jet airliners crossing the continents and the oceans in literally zero time in the westerly direction; nuclear-energy-powered aircraft, first as bombers capable of multiple non-stop circumnavigation of the globe, secondly as passenger airliners; helicopters carrying all airline traffic over distances of 150 miles or less; flying-boats with speed matching that of the equivalent landplane but with greater capacity for cargo, passengers or weapons; fully automatic airline flight operations through electronic guidance and control equipment; and reductions in the cost of air travel well below that of any other form of transportation."

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Stressed-skin Pioneering

IN the article "The First Fifty Years" in your issue of December 11th, the claim is again made that the Short Silver Streak of 1919 was the first to have a stressed-skin fuselage.

Whilst not wishing to decry Mr. Oswald Short's pioneering work in this field, I would venture to point out that load-carrying metal skins were introduced by Dornier as early as 1917.

The Dornier Cs1 of that year was a two-seater, braced-low-wing, twin-float seaplane. This had a metal-skinned fuselage of rectangular section with large corner radii. Although probably inefficient by modern standards, it was in fact a pure monocoque, as no longitudinal members were used.

In the following year, 1918, Dornier produced the D.1, a single-seat fighter biplane. This remarkable aircraft not only had a metal fuselage, but also stressed-skin cantilever wings! I have seen this aircraft myself in the Dornier Museum at Friedrichshafen and was very impressed by the clean lines and apparent stiffness of the structure.

Some confusion may exist over the precise definition of the term "stressed skin." In general this implies that bending end-loads, torsion and direct shear are carried by the skin, or skin/stringer combination. I do not know the structural details of the Silver Streak, but the above Dornier products may certainly be considered to have utilized stressed skin.

There may have been earlier examples of this method of construction; could it be that the Junkers J.1 of 1915, which you mention as being of welded steel sheet, was one of them?

Totternhoe, Beds. LYNDON G. MCFARLANE.

[We submitted a copy of the above letter to Mr. Oswald Short, who comments as follows—ED.]

"I was unaware that Dornier had made the metal box-like fuselage described by your correspondent. Although such a structure could properly be termed 'a stressed-skin structure', it did not inspire the design and construction of the Silver Streak, nor did it add anything to the advancement of aircraft construction.

"On the other hand, the Silver Streak introduced a new system of aircraft construction by which perfect streamlined forms could be made in the outer skin itself. Also, the greater mass of the metal was placed at the greatest distance from the longitudinal axis where, because of its circular form (in section), it would provide the strongest form, to withstand bending and torsional pressures, for a given weight of structure.

"Junkers, the German aircraft designer, followed my system of construction. When starting in January 1927, he built the Ju86. Dornier, who visited our works at Rochester and saw the Singapore I flying-boat, afterwards said to Mr. Robert Blackburn: 'We thought we knew all about metal aircraft construction in Germany, but I have learned something in England.' The German writer on aeronautics, Von C. Walther Vogelfang, wrote in his book, *Das Wunder der Gross und Riesenflugzeuge*: 'The Silver Streak marked an epoch in aircraft construction.'"

Referred to in the letter from Mr. Lyndon G. McFarlane on this page are the Dornier Di single-seat fighter, the Dornier Cs1 two-seat floatplane and (right) the metal fuselage structure of the Cs1.

Mr. Shenstone's Paper

THIS meeting of shop stewards and panel representatives, covering all grades employed by B.E.A.C. Engineering Base at London Airport, having studied the paper which Mr. Shenstone read to the Institute of Production Engineers on December 19th, fully supports the constructive criticism made by him.

We deplore the fact that, in order to create sensational news, the Press has distorted the issues raised by Mr. Shenstone, and has shown a complete disregard for the future of Britain's exports of civil aircraft.

We would appreciate the same degree of publicity being given to our support of our chief engineer as the attacks on Mr. Shenstone received.

London Airport. ALL PANEL SECRETARIES.

[The above letter is signed by the secretaries of the following local panels and/or committees: Joint Panel; Maintenance and Repair Engineering; Supervisory, Engineering and Technical; Draughtsmens', Planners' and Tracers'; Radio (Industrial); Clerical.—Ed.]

THERE is a lot to be said both for and against outspoken criticism, and to live in a country where criticism is forbidden must be intolerable. But there is one unfortunate thing (obviously overlooked by most newspaper reporters) to be remembered in this connection, and as a frequent traveller abroad I would like to draw your readers' attention to it. Foreigners do not always read criticism in the context or spirit in which it is written or spoken. This may be due to the language difference, or in the case of English-speaking foreigners, it may also be intentional. So what? you may ask. Well, almost anyone in the export trade will answer that one. Our rivals in business in a market which is getting more competitive each week are certainly not slow to seize on and use to their own advantage any titbit of adverse criticism of British products, especially if it comes from a qualified man speaking about the goods made in his own country.

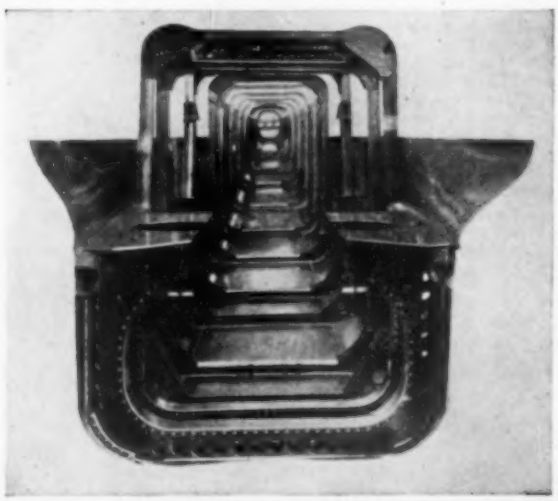
Once upon a time this might have been considered unethical, but today it is apparently accepted as good salesmanship. I would be the last to suggest substituting cut-throatery for our traditional methods, which on the whole are respected overseas, but so many companies and representatives lack enterprise, are pitifully slow to take action, and are afraid to spend a pound abroad to make a hundred. It would be a start if some export departments could just sound more enthusiastic. But the most important things are still the quality, price and delivery dates of the product. Condition and appearance at the time of delivery also count for a lot.

I have a private bet with myself as to which country I shall be in when I first hear that it is quite the practice in British aircraft factories to drag the units across the hangar floor before they are assembled. And now please excuse me while I speak to a designer friend who has just come into the Club. I have a word of constructive criticism to whisper in his ear.

London, W.1. G. SAUNDERS.

IN BRIEF

A reader in Holland, Mr. B. C. F. Klein, c/o W. Lorestraat 17g, Leeuwarden, is endeavouring to obtain three-view scale drawings of the Douglas XB-42 Mixmaster and XB-43 Jetmaster and Chance-Vought XF5U-1 "Flying Flapjack"; he wonders if any readers in Britain, America, or elsewhere can assist.



SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

R.N.Z.A.F. HONOURED: The Queen presents her Colour to the Royal New Zealand Air Force. The ceremony took place at Whenuapai on December 28th. FJO. M. F. McD. Palmer was the Colour bearer, and on the right is A.V-M. D. V. Carnegie, C.B., C.B.E., A.F.C., R.A.F., Chief of the Air Staff, R.N.Z.A.F.

Squadrons Exchange Duties

AFTER having operated with the security forces in Malaya since August last, No. 83 Squadron (S/L. W. C. Sinclair, A.F.C.) is to be relieved by No. 7 Squadron (S/L. D. S. Saunders).

On their way home, the first Lincolns of No. 83 Squadron left Tengah on January 7th, and those of No. 7 Squadron were due to start on the journey east on the same day. The staging posts to be used are Idris (Tripoli), Habbaniya (Iraq), Mauripur (Pakistan) and Negombo (Ceylon).

A number of the squadron ground-crews will travel in the Lincolns; the remainder will be flown by Transport Command.

Carriers in the Spring Cruise

FOR the spring cruise, H.M.S. *Eagle*, wearing the flag of the Flag Officer Heavy Squadron (Rear-Admiral W. T. Couchman, C.V.O., D.S.O., O.B.E.), will leave Devonport with an escorting destroyer on January 25th to embark her air squadrons and carry out flying practices in the English Channel before proceeding to Portland. On her arrival there on January 29th other available ships of the Home Fleet will be assembled.

Eagle, and ships under the command of the Flag Officer Flotillas (Rear-Admiral J. W. Cuthbert, C.B., C.B.E.), will sail from Portland on February 5th for Gibraltar, carrying out exercises on passage, and on arrival at "The Rock" weapon training will take place for about a month.

In March the Fleet will leave Gibraltar for combined exercises with ships of the Mediterranean Fleet in the Western Mediterranean and approaches to Gibraltar. The Home Fleet Training Squadron, consisting of H.M.S. *Implacable*, wearing the flag of the Flag Officer Training Squadron (Rear-Admiral W. L. G. Adams, O.B.E.) and *Indefatigable* will be taking part in these combined exercises while on a short independent cruise to the Mediterranean.

Following the exercises, ships of the Home and Mediterranean Fleets will assemble at Gibraltar, where staff discussions and combined Fleet sporting activities will take place.

Two R.A.F. Appointments

HAVING completed two years as A.O.C. No. 42 Group, Maintenance Command, A. Cdre. J. Marson, C.B., C.B.E., is to become Vice-President of the Ordnance Board, M.o.S.

The second appointment is that of A. Cdre. A. Earle, C.B.E., who has been appointed Director of Personnel (A) at the Air Ministry. Since July 1952 he has been Commandant of the Royal Australian Air Force Staff College and previously to that he was Deputy C.A.S. of the R.A.A.F.

New C.O. for No. 3602 F.C.U.

THE appointment is also announced of W/C. W. T. Walker to command No. 3602 (City of Glasgow) Fighter Control Unit, R.Aux.A.F. at R.A.F. station Bishopbriggs, Glasgow. W/C. Walker joined the special duties branch of the R.A.F.V.R. in 1941 and was controller in the operations room at R.A.F. Ouston, before becoming G.C.I. controller at No. 325 Wing, N.W. African Air Force, and then at No. 8001 Air Experimental Station, North African Air Force. He later served at Bomber Command Pool at Little Snoring. W/C. Walker joined the R.Aux.A.F. in 1949.

Cranwell's New Magazine

DESCRIBED by its editorial staff as "a magazine with (we hope) a difference . . . and something a little better than usual" *The Poacher* has been produced by the Royal Air Force College, Cranwell, as a monthly publication covering College activities and containing articles of aviation and general interest. The contents and format of the first issue suggest that the claim is well founded. *The Poacher* is available at 1s (annual subscription, 15s) to both Service and civilian readers.

The Navigation School Accident

WITH deep regret we record the accident at Aldbury, Herts, on January 6th, in which 16 of 17 men in a Valetta from the Navigation School, Thorney Island, lost their lives. They were members of a rugby football team which had visited Halton.

Bad weather had caused the aircraft to use Bovingdon, and the accident occurred shortly after take-off at 5.15 p.m. on the return journey. Snow was falling thickly, and the Valetta struck trees on high ground some five miles to the north of the airfield. The only survivor was P/O. P. D. Cliff, and those who lost their lives were: F/L. P. Clave, F/O. P. Condé, P/Os. J. K. Noyce, J. A. F. James, R. Nicholson, J. D. Pell, J. N. Clay, D. H. Barton, E. Casey, M. Shimwell, M. P. H. Pollard, A. W. V. Purcell, M/Sig. T. B. Lightfoot, F/Sgt. R. D. Marshall, Cpl. K. C. Tatlow, L.A/C. B. Davies.

F/O Condé was the captain of the Thorney Island rugby team and P/O. Pollard, who was well known as a Rugby Union player, was a member of the R.A.F. XV last year.

Half-yearly Promotions

THE following names continue the list of half-yearly promotions issued by the Air Ministry. The higher ranks appeared in our issue of January 8th, page 56.

GENERAL DUTIES BRANCH. *Wing Commander to Group Captain.*—F. H. Tyson; G. N. Amison; R. E. Burns, D.F.C.; D. S. Wilson-MacDonald, D.S.O., D.F.C.; S. Wroath, A.F.C.; C. F. C. Wright, D.S.O., D.F.C.; G. P. Seymour-Price, D.F.C.; R. J. Abrahams, O.B.E.; R. J. P. Prichard, O.B.E., D.F.C., A.F.C.; C. H. Simpson; F. A. Willan, D.F.C.; J. N. W. Farmer, D.F.C.; F. M. Milligan, O.B.E., A.F.C.; H. E. Bufton, D.S.O., D.F.C., A.F.C.; G. F. Powell-Shedden, D.S.O., D.F.C.; R. M. B. D. Duke-Woolley, D.S.O., D.F.C.; A. V. R. Johnstone, D.F.C.; E. G. Jones, D.S.O., O.B.E., D.F.C.; H. I. Edwards, V.C., D.S.O., O.B.E., D.F.C.; C. D. Tomalin, O.B.E., D.F.C., A.F.C.; G. T. B. Clayton, D.F.C.; D. F. Spotswood, C.B.E., D.S.O., D.F.C.; R. F. Aitken, O.B.E., A.F.C.; S. W. R. Hughes, O.B.E., A.F.C.; D. C. McKinley, D.F.C., A.F.C.

Squadron Leader to Wing Commander.—P. D. W. Hackforth; D. E. Bennett; L. M. Gilchrist; R. I. Alexander, D.F.C.; D. R. Griffiths, D.F.C.; L. J. M. Bunce; A. B. Goldie; F. N. Brinsden; H. A. England, D.F.C.; H. L. Derwent, A.F.C.; L. J. Ward, D.F.C.; J. L. Nunn, D.F.C.; S. C. Ladyman; H. H. Eccles; J. R. Gardner; B. Deaves, D.F.C.; M. J. A. Shaw, D.S.O.; J. H. S. Broughton, D.F.C., A.F.C.; P. O. V. Green, A.F.C.; P. L. Parrett, D.F.C., A.F.C.; H. F. O'Neill, D.F.C.; P. D. B. Stevens; R. J. E. Boulding; D. N. Fearon; P. J. S. Finlayson, A.F.C.; P. J. Simpson, D.S.O., D.F.C.; G. Kennedy, A.F.C., D.F.M.; F. H. Stubbs, A.F.C., D.F.M.; F. R. Flynn, A.F.C.; F. F. Addington, D.F.C.; F. Squire, D.S.O., D.F.C.; W. McRobbie, A.F.C.; G. C. Unwin, D.S.O., D.F.M.; A. McC. Johnstone, O.B.E., A.F.C.; L. V. Bachellier, A.F.C.; J. M. Rowe, D.F.C.; R. I. Crump, A.F.C.; L.

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Flight Lieutenant to Squadron Leader.—W. Allsopp; S. R. Pescock-Edwards, D.F.C.; J. Tilsley; T. A. Gallagher; M. G. Birt, D.F.C., A.F.C.; T. James; P. V. Ayerst, D.F.C.; A. C. M. Millar; A. H. Crowe, D.F.C., A.F.C.; M. Kotlarz; W. J. Johnson, D.F.C.; D. W. Jones, D.F.C.; H. G. Coldbeck, D.F.C.; C. J. Lofthouse, O.B.E., D.F.C.; A. D. Jillings; D. S. Iles; J. H. Lewis; E. J. Lisle, D.F.C.; N. Hoyle; D. H. T. McRea, D.F.C.; J. C. Cox; J. G. Wynne, D.F.C.; B. A. Templeman-Rooke, D.S.O., D.F.C., A.F.C.; R. H. Hardy, D.F.C., D.F.M.; A. G. M. Sutherland, D.F.C.; N. R. Stevens; G. F. Turner, D.F.C.; D. A. Lloyd, D.F.C., D.F.M.; G. K. N. Lloyd; V. Bridges, D.F.C.; J. Purcell, B.E.M.; W. L. Griffiths; K. Lister, D.F.C.; H. J. Franklin; J. J. Canning, D.F.C.; R. G. Driver; G. P. Elliott; F. J. Trueman, D.F.C.; G. Blakeman; G. M. Smith; W. T. Haxby, D.F.C., A.F.C.; H. G. Pattison, D.F.C.; P. H. Baker; A. J. Jacomb-Hood, D.F.C.; D. H. Downs; D. C. Usher, D.F.C., D.F.M.; R. L. E. Burton, A.F.C.; H. B. F. Lymna, D.S.O., D.F.C., D.F.M.; A. Yates; R. S. Smith, A.F.C.; W. J. Hibbert, D.F.C.; C. J. Samouelle, D.F.C.; P. W. Ellis, D.F.C.; G. A. Catling; G. K. Bushell; C. C. Ellison, D.F.C.; H. F. McNabb, D.F.C.; F. Easley; J. P. G. Dow; R. B. Sillars; M. T. Harding; E. C. Gough; H. Neubroch; L. C. Bazalgette; W. P. Swaby; J. A. Simpson, D.F.C., A.F.C.; P. Ainley, D.F.C.; G. J. Daly, D.F.C.; D. R. Baxter, D.F.C.; P. G. Sinclair; M. Mays; R. F. Hitchcock; D. G. Maddocks, D.F.C.; P. G. R. Grealy; A. G. Brown, D.F.C., A.F.C.; J. C. Stuart, D.F.C.; E. M. Higson; J. I. S. Digman, D.F.C.; R. T. Duck; D. N. P. Batty; B. H. Howard, D.F.C.; D. R. Locke; W. O. Mitchell, D.F.C.; G. G. G. Walkington; A. Barrell; B. G. Lock; J. F. Manning, A.F.C.; W. D. Hooper, A.F.C.; A. E. Marriott; F. C. Barter, A.F.C.; J. J. Cooper; R. R. Rawlins; P. R. Mallorie, A.F.C.; K. M. Ashley; P. T. Bayley.

(To be continued)

Admiral Sir Guy Royle

IT is with regret we announce the death of Admiral Sir Guy Royle, K.C.B., C.M.G. He collapsed and died while helping to put out a heath fire near his home at Wimborne.

From 1939 to 1941 Sir Guy was Fifth Sea Lord and Chief of Naval Air Services. His first connection with the Fleet Air Arm came when he was appointed to command the aircraft carrier H.M.S. *Glorious* in the Mediterranean from 1932 to 1934.

In 1939 he became Rear-Admiral Aircraft Carriers and flew his flag in the *Courageous* and the *Ark Royal*. On becoming Fifth Sea Lord in November 1939, he was responsible for the big expansion of the Fleet Air Arm to wartime strength.

The Aries Story

THE Canberra bearing the honoured name of *Aries IV* made an auspicious start to its career—by setting up new two way records between London and Capetown on the 50th anniversary of the Wright brothers' first powered flight. This trip alone entitles the new *Aries* to take its place with the older aircraft of similar name.

The name *Aries* was first used by The Empire Air Navigation School, which later merged, with the other Empire Schools, into the R.A.F. Flying College at Manby, Lincs.

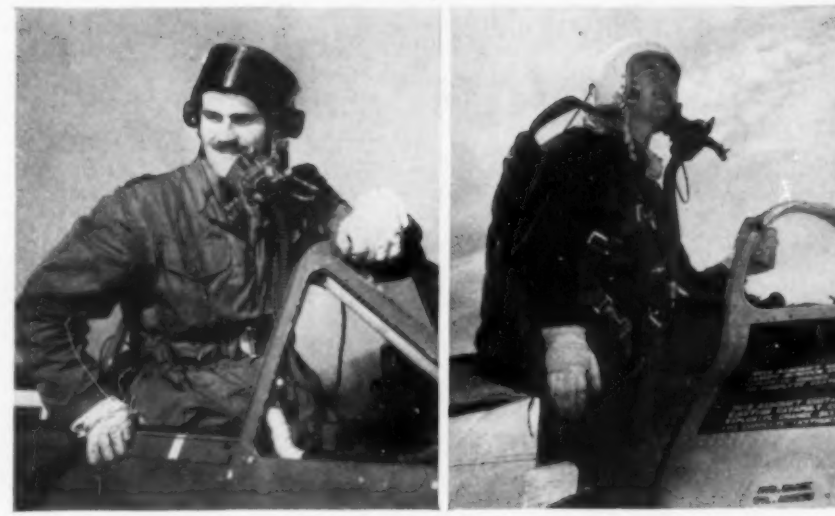
Aries I was an Avro Lancaster, modified with Lancastrian nose and tail fairings and specially converted for long-range flying. It began its flying career in 1944 by circumnavigating the earth in 40 days, covering a total distance of over 47,000 miles during the journey and, incidentally, also establishing a new record to the Cape. In all, *Aries I* flew nearly 200,000 miles, or the equivalent of seven more flights round the world. It made liaison trips to Canada and the United States in 1945 and, two days after V.E. Day, left on one of the most spectacular flights ever made at the time—over the North geographic and magnetic poles. When it returned after two weeks, it had flown a total of 28,700 miles, of which nearly 20,000 miles had been over Arctic regions.

In 1946, the last year of its career, *Aries I* established official records on the routes from London to Karachi, London to Darwin, and London to Wellington. It also flew non-stop from Cairo to the Cape. In the autumn of that year, before *Aries I* was disposed of in January, 1947, a liaison flight was made to Canada and the U.S.A.

Aries II, a specially converted Avro Lincoln, took over at the Empire Air Navigation School; and two days after being named by Lady Coningham, wife of the late Air Marshal Sir Arthur Coningham (then A.O.C-in-C. of Flying Training Command), it was flown to Singapore. During the next 11 months it made long-distance flights to South Africa, the Middle East, Canada, the U.S.A. and Australasia, in the course of which it flew over 70,000 miles. Its end came just before a planned flight in January 1948—it caught fire during re-fuelling and was burnt out.

A second specially modified Lincoln was named *Aries III* and in 1949, shortly after the formation of the R.A.F. Flying College, it was transferred from Shawbury to Manby. In October 1950, it took off on a global flight of 29,000 miles during which the official London-Khartoum record was broken. Subsequently this aircraft made flights to the Arctic and Alaska and completed more routine navigation exercises to Bermuda and Ascension Island, on all of which a total of some 50,000 miles were flown. Early last year this Lincoln's flying days came to an end and thus the name *Aries* handed on to an English Electric Canberra of the R.A.F. Flying College.

The grand total flown by the three piston-engined Aries aircraft was 352,000 miles—113,000 miles more than the distance to the moon (238,946 miles).



OLDER AND NEWER: The Venom pilot (left) is wearing standard R.A.F. clothing, less Mae West, with an early-type visor. In contrast, the Sabre pilot wears crash helmet, pressure breathing mask, "pigtail" intercom lead, back-type parachute and American overalls; he is also using the Sabre's alternative starboard access steps. The Venom illustrated does not have an ejector seat.

Two R.O.C. Appointments

AMONG recent Royal Observer Corps appointments are those of Obs. Capt. C. G. Cooke, O.B.E., as Acting Area Commandant of the Eastern Area H.Q. at Norwich, and Obs. Capt. W. Rusby, who becomes Deputy Commandant of the R.O.C. at Bentley Priory, Stanmore, Middx.

R.A.A.F. Honours

THE names of crew members of the R.A.A.F. Canberra crews in the England to New Zealand Race were among those included in the Australian Commonwealth Lists in the New Year Honours. (Names of R.A.F. personnel in the Honours List were given in our last week's issue.) W/C. Cuming receives the O.B.E. and S/L. Raw the Air Force Cross.

The complete R.A.A.F. list is as follows:

C.B.E.—A. Cdre. I. D. McLachlan, D.F.C.

O.B.E.—G/C. F. Headlam, G/C. J. W. Reddrop, W/C. D. R. Cuming, A.F.C.

M.B.E.—S/L. J. Tennent, S/L. H. M. Bain, F/L. T. G. Phillips, W/O. E. Avery, W/O. J. A. C. Negus.

A.F.C.—S/L. P. F. Raw, D.F.C., F/L. W. H. Scott, F/L. A. J. Bunyan, F/L. F. R. Davies, W/O. R. Rosevear.

B.E.M.—F/S. G. H. Stirzaker, Sgt. H. V. Carne, Sgt. J. B. McCallum, Sgt. H. T. Moore.

Royal Red Cross (Second Class).—Matron A. T. Cleary.

F/L. T. C. McGrath, F/O. L. R. Watkin and W/O. F. J. Wood each received a Commendation for Meritorious Service in the Air.

Reunion

THE fourth reunion for all ranks who served in the R.A.F. in Aden and its outstations during 1939-45 will be held at the Eccleston Hotel, London, S.W.1, on Saturday, February 27th, 6.30 p.m. Details may be had from Mr. T. C. Stevens, 34, Ivere Drive, Barnet, Herts.

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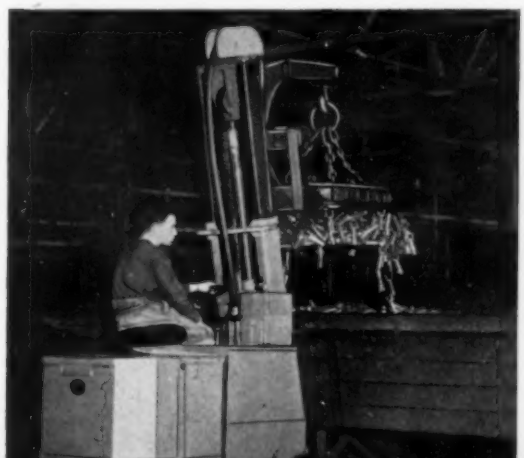

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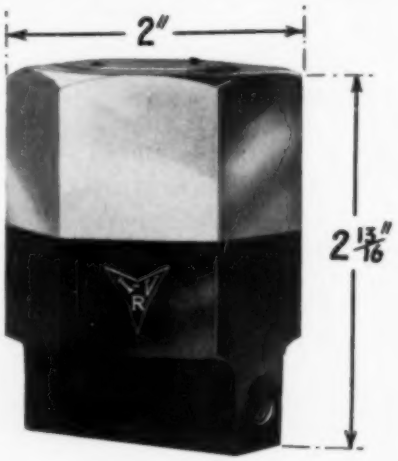

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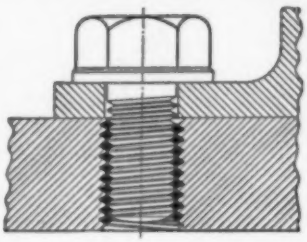

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

Application No. 250 from Transair, Ltd., of Croydon Airport, Surrey, for a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers and supplementary freight between London (Gatwick) and Graz (Austria) at a frequency of from one service fortnightly to two services weekly during the season from May to September inclusive, for a period of five years commencing May 1st, 1954.

Application No. 251 from Air Charter, Ltd., of 15 Great Cumberland Place, London, W.1, for a colonial coach service, initially with Avro Tudor aircraft and later possibly with Argonaut aircraft, for the carriage of passengers and supplementary freight between London (Stansted) and Lagos at a frequency of from one service weekly to one service daily during the period from April 1st, 1954, to March 31st, 1964.

Application No. 252 from Hunting-Clan Air Transport, Ltd., of 5 Fitzhardinge Street, London, W.1, for a colonial coach service with Viking aircraft for the carriage of passengers and supplementary freight between London (Bovingdon) and Malta operated jointly with Airwork, Ltd., at a combined frequency of from two to seven services weekly during a seven-year period from date of approval.

From Lancashire Aircraft Corpn., Ltd., of 7 Berkeley Street, London, W.1:—

Application No. 253 for a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers and supplementary freight between Blackpool (Squires Gate) and Dinard at a frequency of one service weekly during the season from June to September inclusive, for a period of seven years commencing June 1, 1954.

Application No. 254 for a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers and supplementary freight between London (Blackbushe) and Palma (Majorca) at a frequency of one service weekly during the season from June to September inclusive, for a period of seven years commencing June 1st, 1954.

Application No. 92/1 from Hunting-Clan Air Transport, Ltd., of 5 Fitzhardinge Street, London, W.1, for permission to include a traffic stop at Stavanger on their normal scheduled service between Newcastle and Oslo and Stockholm (Application No. 92), which has been approved by the Minister of Transport and Civil Aviation until March 31st, 1960.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30th, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9 Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the council, should reach them within the period allowed for the making of representations or objections.

THE Council give notice that the following application is now to be treated as withdrawn:—

Application No. 235 from Seawings, Ltd., of 19 Fenchurch Street, London, E.C., for a seasonal inclusive tour service between Southampton (Marine) and Ibiza (Balearic Islands) with Sandringham flying boats, which was advertised in *The Times* on December 24, 1953, and in *The Aeroplane* and *Flight* on December 25th, 1953. [1511

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Qualifications: Degree of high standard in civil or mechanical engineering with experience in research and development establishments in the planning of major scientific facilities, or equivalent qualifications.

Position No. 2 **TRIALS TECHNIQUES**

Duties: Responsible for the development and application of trials techniques and the critical analysis of trials methods and results.

Qualifications: Degree of high standard in science, physics and mathematics as major subjects, with experience or advanced study in the design of experiments or experimental techniques, or equivalent qualifications.

Position No. 3 **CONTROL AND GUIDANCE**

Duties: Responsible for the experimental study of problems in the control and guidance of guided missiles, their solution by analogue computing techniques, and the formulation of corresponding full scale experiments.

Qualifications: Degree of high standard in science or engineering, together with research and development experience in allied duties, or equivalent qualifications.

Position No. 4 **FLIGHT STUDIES**

Duties: Research on the primary aspects of guided missiles, including aerodynamic and propulsion parameters.

Qualifications: Degree of high standard in aeronautical engineering, together with experience in aerodynamic research and development, or equivalent qualifications.

Position No. 5 **PHOTO MECHANICAL**

Duties: Responsible for the development of special-purpose cameras and accessories necessary for the instrumentation of guided missile tests and trials.

Qualifications: Degree of high standard in science or engineering with experience in the development of special-purpose cameras for scientific and technical applications, or equivalent qualifications.

Position No. 6 **MECHANICAL INSTRUMENTS**

Duties: Responsible for the development of various types of precision mechanical recording instruments for the instrumentation of guided missile tests and trials.

Qualifications: Degree of high standard in science or engineering, with experience in the development of precision mechanical instruments, or equivalent qualifications.

Position No. 7 **MATHEMATICS**

Duties: Advise Research Groups on the most suitable mathematical and numerical methods to be employed in the solution of problems, and to undertake the solution of problems requiring specialized mathematical and numerical techniques.

Qualifications: Degree of high standard in mathematics, together with experience in allied duties, or equivalent qualifications.

Position No. 8 **ELECTRONICS**

Duties: Responsible for a Section concerned with the development of electronic systems for the instrumentation of missiles in flight.

Qualifications: A degree of high standard in science or engineering, together with extensive experience in electronic development work or equivalent qualifications; experience in the design of radars, or other electronic aids, is desirable.

The Headquarters of the Long Range Weapons Establishment is situated at Salisbury, 16 miles from Adelaide in South Australia, where approximately 200 scientists and engineers, with appropriate ancillary staffs, are engaged in this joint Australia/United Kingdom project. General research and development work is carried out in laboratories established there in the fields of aerodynamics, control and guidance of missiles, design of optical and electronic equipment required for trials, and computation and analysis of trials results.

The salaries quoted are in Australian currency.

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(Continued on next classified column

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(continued from foot of previous classified column)

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Further information, including details regarding the nature of the work and applications forms, may be obtained from

SENIOR REPRESENTATIVE (A.P.5),
Department of Supply,
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PATENTS

THE proprietor of British Patent No. 610143, relating to a device for efficiently controlling aircraft at all speeds up to and above Mach 1, is desirous of entering into negotiations with firms in this country for the purpose of exploiting the above invention, either by sale of the patent rights or by granting of licences to manufacture on a royalty basis.—Enquiries should be addressed to Abel and Imray, Quality House, Quality Court, Chancery Lane, London, W.C.2. [1507

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SAUNDERS-ROE, Ltd., Helicopter Division, at Southampton Airport, invite applications for the following vacancies in their design staff:

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TWO technicians. A university degree is essential but industrial experience is not required. One position is in the Aerodynamics and Vibration Section, where some knowledge of vibration theory is desirable. The second vacancy arises in a design team engaged on project investigations and requires a strong basic knowledge of aerodynamics and structures with a mathematical bias.

SALARIES for the above positions will be commensurate with experience and qualifications. Housing assistance may be given to successful applicants.

PLEASE reply, giving full particulars, to the Personnel Officer, Saunders-Roe, Ltd., East Cowes, I.O.W. [1487

SKYWAYS, Ltd., require aircraft engineer with York/Merlin A. and C. licences for Mediterranean base. Generous allowances.—Write, Personnel Manager, 7 Berkeley Street, W.1. [0290

AIRWORK GENERAL TRADING Co., Ltd., require aircraft engine and airframe fitters for maintenance of Viking and Hermes aircraft.—Apply, in person or by writing, to the Service Manager, Blackbushe Airport, nr. Camberley, Surrey. [1498

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RESEARCH engineers, aged 25-32 years, with engineering degree and experience on aircraft equipment. Works in Slough, Bucks area.—Write giving particulars of education, experience and salary required to Box 2724. [1514

SALES engineer required with tool room experience, by expanding firm. Pref. with contacts for aircraft and trade tooling. Please state experience, age and salary to Campbell Eng. Co., Sherman Works, Bromley, Kent. [1509

SENIOR and intermediate design draughtsmen with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612

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APPLY with full details and salary required, quoting No. 1439, to Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middx. [1429

REQUIRED immediately by Percival Aircraft, Ltd., Luton Airport, Beds, several draughtsmen with comprehensive experience of engine installation and allied systems. Good welfare facilities, including staff pensions scheme.—Applications in writing, stating age, qualifications, experience and salary required to the Personnel Manager. [0601

TEST laboratory assistants (male) required by Percival Aircraft, Ltd., Luton Airport, Beds. National Certificate standard and previous experience on design of test laboratory equipment desirable. Good welfare facilities including staff pension scheme.—Applications, stating qualifications, experience, age and salary required to Personnel Manager. [0596

SENIOR structural and mechanical test engineer required to supervise an interesting programme of test work on fixed and rotating wing aircraft. Good welfare facilities including staff pension scheme.—Applications in writing to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds, stating age, experience and salary required. [0594

OPPORTUNITIES exist for first-class senior and intermediate airframe stressmen in the development of new projects. Permanent posts at good salaries for suitable applicants.—Applications, in writing, should state age, experience and salary expected, and be addressed to the Chief Designer, Auster Aircraft Ltd., Rearsby Aerodrome, Leicester. [1518

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their Design Office for senior and intermediate stressmen and for senior, intermediate and junior weightsmen. They are required for work on an interesting new project with good opportunities for advancement.—Please send full particulars of experience, etc., to the Personnel Officer. [0235

PILOT, commercial licence, endorsed Rapides and Geminis, instrument rating and R/T licence, required for schedule service and Army co-operation taxi/charter flying. Instructor's endorsement an advantage.—Apply, in writing in first instance, giving full details of qualifications and experience, to Derby Aviation, Ltd., Municipal Airport, Burnaston, nr. Derby. [1501

AIRCRAFT engineer (electrician) required by Far East maintenance company. Must have up-to-date experience, "X" licence for equipment below 30 volts. Endorsements for high voltage or ignition apparatus advantageous. Argonaut experience essential. Good pay and conditions.—Write, stating age, details qualifications and experience to Box P138, c/o Streets, 110 Old Broad Street, E.C.2. [1516

DRAUGHTSMEN, Senior and Intermediate, required in connection with the design and fabrication of light alloy and stainless steel aircraft components. Applicants should have Ordinary National or equivalent. Aircraft experience an advantage.—Write, giving details of age, experience and qualifications, to Chief Draughtsman, Delaney Gallay, Ltd., Edgware Road, Cricklewood, N.W.2. [1454

AIR FORCE, Naval, civil and helicopter aircraft all under deisgn and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen and stressmen for work on this interesting programme. Good welfare facilities, including staff pension scheme.—Write, giving details of experience and salary required, to Personnel Manager. [0595

THE ENGLISH ELECTRIC Co., Ltd., have vacancies for technical assistants of H.N.C. standard to take charge of development structural tests as part of a comprehensive programme of testing on guided weapons. Previous experience of structural development or aircraft stressing an advantage.—Applications to Dept. C.P.S., 336/7 Strand, W.C.2, quoting ref. 1147E. [1472

SITUATIONS VACANT

ARMSTRONG SIDDELEY MOTORS, Coventry, have vacancies for a number of designers and senior and junior draughtsmen. Although gas turbine experience is most advantageous it is not necessarily essential as training will be given in this specialized work to suitably qualified draughtsmen.—Apply in detail to Reference F.103, Personnel Manager, Armstrong Siddeley Motors, Coventry. [0200

ARMSTRONG SIDDELEY MOTORS require a technical assistant for experimental work on aero engines (gas turbine) in particular, flight analysis, performance and development. Applicant should possess degree or equivalent and preferably have completed National Service.—Apply, in writing, with full details to Personnel Manager, Armstrong Siddeley Motors, Coventry. [1488

OPPORTUNITIES exist for first-class senior and intermediate aircraft design draughtsmen to play a prominent part in the design of completely new projects. Permanent posts at good salaries for suitable applicants.—Applications, in writing, should state age, experience and salary expected, and be addressed to the Chief Designer, Auster Aircraft Ltd., Rearsby Aerodrome, Leicester. [1517

FLIGHT trials analysis engineer required by The English Electric Co., Ltd., Luton. The work covers both assessment of the results of flight tests on guided weapons and the planning of further tests. Applicants should have a degree or H.N.C. and preferably some knowledge of supersonic aerodynamics and instrumentation techniques.—Please write, giving full details of experience and qualifications, to Dept. C.P.S., 336-7 Strand, W.C.2, quoting Ref. 1043C. [1502

VACANCIES exist at the laboratories of Smiths Aircraft Instruments, Ltd., near Cheltenham, for one experienced technical author and a technical illustrator for work on publications describing electrical and mechanical instruments. The author is expected to work on the preparation of instruction manuals to A.R.B. requirements and must have a sound engineering and electrical background. The illustrator will be expected to work on spare parts lists and instruction manuals, and must have suitable previous experience.

THE laboratories are situated in pleasant Cotswold country 3 miles north of Cheltenham, and the facilities provided by the company's athletic and social club include those for riding, sailing and flying, in addition to the usual sports facilities. The company will give what assistance they can in obtaining housing for successful applicants.

APPLICATIONS, with details of qualifications, experience and salary required, should be made to the Personnel Department, S. Smith and Sons, Bishops Cleeve, near Cheltenham, Glos., quoting reference number 20/EN. [1492

VACANCIES exist in the Cheltenham laboratories of Smiths Aircraft Instruments for aeronautical or electrical engineers having experience of electric and hydraulic servo mechanisms, radio navigation equipment and experimental flight testing. A good general knowledge of aircraft construction and operation is essential. Applicants should hold a degree or equivalent, have a medical standard equal to Class "A" life insurance, and should be willing to travel within the U.K. and abroad.

THE salary range is from £675 to £975 p.a. and the starting salary in this range will depend on qualifications, age and experience.

THE company will give what assistance they can in obtaining housing for successful applicants.

APPLICATIONS with details of qualifications, experience and salary required, should be made in writing to Personnel Department, S. Smith and Sons (England), Ltd., Bishops Cleeve, near Cheltenham, Glos., quoting reference 18/EN. [1491

SITUATIONS VACANT

TECHNICIANS Grade I (radio) required by East African Posts and Telecoms Administration on probation for pensionable employment. Salary, etc., in scale £742 rising to £1,134 a year. Outfit allowance £30. Free passages. Liberal leave on full salary. Normal tour four years. Candidates should possess a thorough practical knowledge of the working and maintenance of radio transmitting and receiving equipment. G.P.O. staff should apply through departmental channels.

WRITE to the Crown Agents, 4 Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/32424/FE. [1500

SENIOR aerodynamicist required. Minimum qualifications B.Sc. or equivalent and five years experience, should be able to undertake stability and control calculations, performance estimates and data for stressing. Also a junior aerodynamicist with sound knowledge of aerodynamics and preferably some experience.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., The Airport, Luton, Beds., stating age, experience, previous positions held and salary required. [1504

THE ENGLISH ELECTRIC Co., Ltd., Luton, have vacancies for senior technicians and mechanical designers to work on rocket motor projects. These posts offer the opportunity of working on advanced designs and obtaining a key position in an expanding industry. Qualifications: an engineering degree or equivalent for technicians and H.N.C. for designers. Previous experience on rocket motors or aircraft powerplants is an advantage.—Applications to Dept. C.P.S., 336-7 Strand, W.C.2, quoting ref. 1024A. [1397

DRAUGHTSMEN with light mechanical engineering background required by Ministry of Supply Research Establishment, Westcott, Bucks., dealing with rocket motors for guided weapons. Quals.: O.N.C. or equivalent in mechanical engineering with at least three years workshop experience. Pay £374 to £517 according to age, rising to £597. Five-day week of 44 hours (including meal breaks); paid sick leave; 20 days annual holiday plus public holidays.—Apply, stating age, quals. and experience, to any Employment Exchange, quoting Order No. Aylesbury 669. [1497

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PRECISION engineering. The Instrument Design Group of The English Electric Co., Luton Division, is being expanded and the services are sought of a senior designer to head up the unit. The work involves design and development of high precision equipment, such as gyroscopes and similar precision equipment, to be used in conjunction with the guided weapons development programme. The position holds considerable responsibility and will be covered by an appropriate salary. Applications from qualified engineers for other positions in this group will also be welcomed.—Applications, quoting Reference 1142C, to Dept. C.P.S., 336-7 Strand, W.C.2. [1435

APPLICATIONS are invited for a number of senior positions in the guided weapon field. Posts are permanent and will be offered to suitable applicants who have either at least five years experience in industry or are graduates with two or more years experience. Salaries will be commensurate with experience and advancement will depend upon original contribution and enthusiasm for the work. The following positions are available: (a) Physicist with experience in electronics (b) circuit engineer, capable of original circuit development and familiar with low frequency circuit designs and miniaturization, and (c) servo engineer, experienced in design and development of light electrically controlled servo mechanisms.—Apply Box Ac86605, Samson Clarks, 57-61 Mortimer Street, London, W.1. [1490

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"A" "B" and "C" licensed engineer, aged 38, requires employment. 20 years' aviation experience. Available immediately. Anything considered, not necessarily aviation industry.—Box 2653. [1495

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INDEX TO ADVERTISERS

	Page
Aero Research, Ltd.	9
Airwork, Ltd.	27, 30
Alvis, Ltd.	18, 19
Armstrong Siddeley Motors, Ltd.	20
Aston and Co., Ltd., E. S.	28
Avica Equipment, Ltd.	16
Boulton Paul Aircraft, Ltd.	3
Bristol Aeroplane Co., Ltd., The	Cover iv, 32
British Air Line Pilots' Association, The	28
British Emulsifiers, Ltd.	26
British Messier, Ltd.	15
Brooklands Aviation, Ltd.	29
Central Office of Information (R.A.F.)	2
Coley Metals, Ltd.	26
Cross Manufacturing Co. (1938), Ltd.	28, 32
Curd Components, Ltd.	28
Decca Radar, Ltd.	Cover ii
Dundas, Ltd., R. K.	27
Electro-Hydraulics, Ltd.	6
Fairey Aviation Co., Ltd., The	Cover i, 17
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Fishers	29
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Lewis, Ltd., D.	27
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"Mechanical Handling"	25
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National Institute of Engineering	31
Northern Mail Order Co.	28
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Percival Aircraft, Ltd.	30
Plessey Co., Ltd., The	12
Redifon, Ltd.	22
Rotax, Ltd.	11, 25
Rozalex, Ltd.	31
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Terry and Sons, Ltd., Herbert	1
T.I. Aluminium, Ltd.	21
Vinten, Ltd., W.	8
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Wilkinson Rubber Linatex, Ltd.	7

Printed in Great Britain for the Publishers, ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1, by SUN PRINTERS LTD., London, and Watford, Herts. *Flight* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd. INDIA: A. H. Wheeler & Co. CANADA: The Wm. Dawson Subscription Service, Ltd.; Gordon & Gotch, Ltd. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co. Entered as Second Class Matter at the New York, U.S.A., Post Office.

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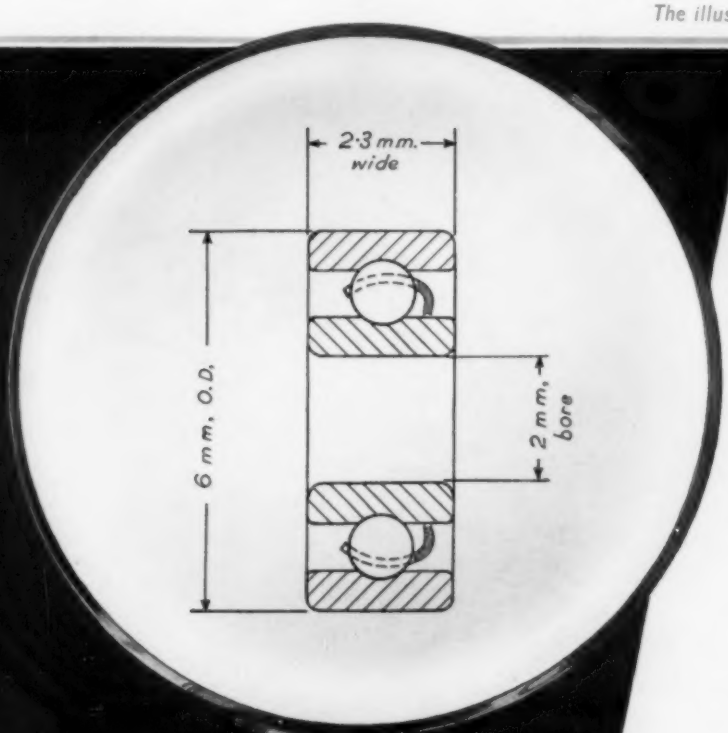

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